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The Modern Highway Bears But Little Evidence of the Large Amount of Transportation Involved in Its Construction.

HAULING EQUIPMENT ON HIGHWAY PAVING WORK

Essential Factors Which Govern Its Efficient Operation

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THE transportation of materials is one of the major operations in all paving work. In most types of paving, such as portland cement concrete and the various asphaltic and bituminous plant-mixes, the delivery of materials must not only be adequate in total quantity but the rates of delivery must be fully synchronized with the rate of demand or production of the mixing plant. The mixer or mixing plant is the key producer. The maximum rate at which it can operate is definitely fixed by specifications and mechanical operating requirements. Consequently any irregularity in the functioning of the hauling equipment sufficient to cause the loss of a batch during one hour cannot be retrieved by speeding up the hauling equipment the next hour. Any loss in production on the part of the key equipment is irretrievable. The main objective of the haulage must therefore be such regularity of delivery of the materials as will fully conform with the operating demand or production rate at the mixer.

For this kind of hauling the truck has at present practically displaced all other forms of transportation. But the size or sizes used vary over almost the entire range of sizes which are manufactured. This is especially true in connection with portland cement pavement. Here no one given truck size appears to have any particular advantage except in particular cases. Thus we have instances of just as high production rates and as low transportation costs having been attained with the common 1½-ton trucks as with any other sizes. In most bituminous work, however, the large truck has practically displaced the smaller sizes for hauling the mix from the plant to the street.

Haulage on Bituminous Work

The reason for this rather contradictory condition as to the size of batch trucks used for batch hauling is not difficult to find. The past 10 or 12 years have been a period of decided development toward the use of large capacity mixing plants in bituminous construction work with relatively no change in the capacity of

The Efficient Operation of Practically Any Paving Work Requires a Transportation Service Which Will Permit Unhampered Production of the Key Producer.

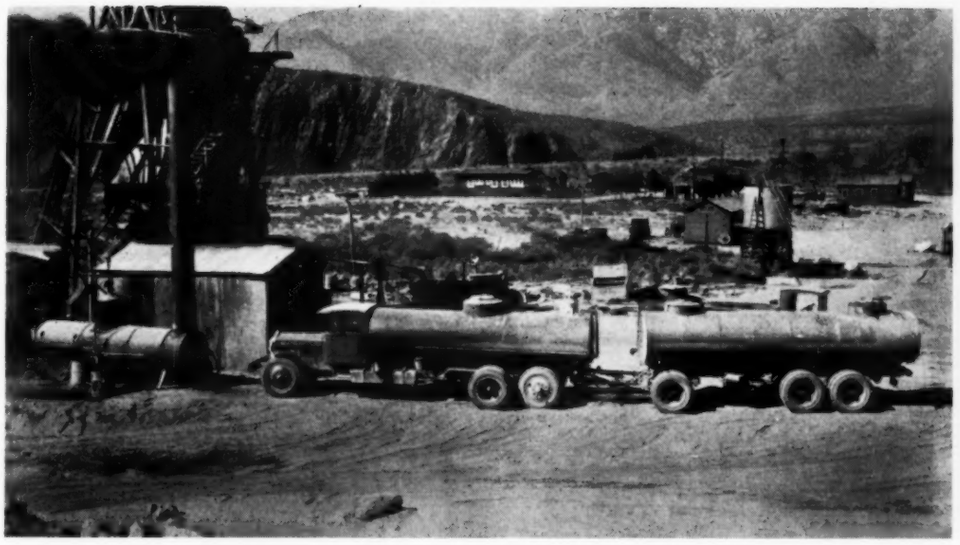
the concrete paver. While the standard concrete paver of today still maintains a capacity of 27 cu. ft. with a rather customary so-called overload allowance of 10 per cent (although tests have shown equally efficient mixing with a 20 or even a 25 per cent overload), the bituminous mixer has increased from the customary 750- or 1,000-lb. capacity of 10 or 15 years ago to two or three times that amount and in some sections to five and six times that capacity. Today semi-portable plants mixing a batch of 2 or 2½ tons are not uncommon. The use of a "gob-box" of a size sufficient to accommodate at least one full load for a heavy truck has also become rather general for all sizes of plants. Even with the smaller plants there is, therefore, no longer any necessity for keeping the hauling vehicle waiting under the mixer while the requisite number of batches for a full load are being mixed. The truck simply comes to the mixer, takes on its load from the "gob-box" and leaves for the street. This reduces hauling costs, for the truck can produce ton-miles of transportation only when loaded and moving toward its destination. It may also be observed that the larger the truck used, the more the ton-miles produced per trip. But the larger the carrying capacity of the truck the greater its daily or hourly cost and consequently the more important that all stops, waits and delays be reduced to a minimum. The large capacity mixer, the general use of the "gob-box" and the general adoption of mechanical spreaders at the unloading point have therefore all tended to favor the use of the large truck and the light truck has practically ceased to be a factor in hauling bituminous mix from the mixing plant to the road.

Haulage on Portland Cement Concrete Work

In portland cement concrete work, however, the light truck still maintains an important place in many sections. Here the amount to be carried per load is one or more standard batches. The light truck quite generally carries two such batches. Larger trucks usually carry three, four or five such standard batches. Each batch, however, must be received, maintained and discharged as a separate entity. Except for the driving time within the batching plant the loading time varies almost directly with the number of batches. There is, therefore, no particular gain insofar as loading time is concerned to be secured from carrying several batches per load.

In unloading the multiple-batch truck is also a decided disadvantage as compared with the smaller truck which can drop its first batch immediately in the waiting skip and its second batch after a wait of one skip cycle or about 12 to 20 seconds and then be gone. The multiple-batch truck can only drop its first batch with equal facility. For the second batch the wait is usually only one skip cycle, but for each batch after this a full mixer

The Use of This 5-Batch Truck Was Fully Justified Since the Haul Was So Long That the Total Time Spent in Loading and Unloading Formed But a Small Proportion of the Total Working Time.



A 60-Mile Haul. The Longer the Haul the Larger the Most Economical Hauling Unit Generally Holds True Within the Limits of the Ready Carrying Capacity of the Road and the Volume of the Required Service.

cycle must elapse. The length of the mixer cycle varies in the several States with specification requirements. In California it is about 62 to 65 seconds while in New Jersey it is about 117 to 120 seconds. But whatever the length of the mixer cycle it enters directly into the time constant of the multiple-batch truck. To this necessary waiting time must also be added any mixer delays which may occur while the truck is in process of unloading. These additional time requirements in loading and unloading are a decided handicap to the big multiple-batch trucks in concrete batch hauling especially on short hauls as illustrated more fully in Table III. Frequently, particular requirements imposed by the inspector or engineer in regard to the handling of the cement or in the operation of the vehicle at the mixer presents additional difficulties which usually bear more heavily on the multi-batch vehicle than on the one carrying only one or two batches.

There are a number of ways in which efforts have been made to reduce this handicap under which portland cement concrete construction is laboring as compared with bituminous mix types insofar as the hauling is concerned. These include the use of the largest permissible batch, shorter mixing time requirements for present standard pavers and the use of tandem and dual-drum pavers, none of which promise more than to ameliorate the handicap imposed on the larger truck by our present batch size limitations. On long hauls and under certain other favorable conditions this handicap is partially overcome. But as usually carried out the hauls are rarely long and a considerable part of the haul is nearly always short.

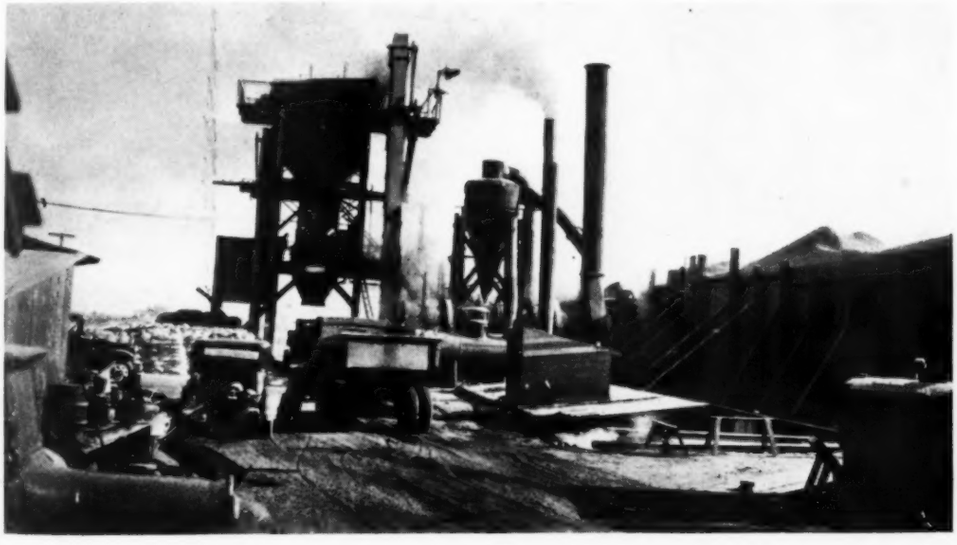
Influence of Fixed Batch Size on Hauling Cost

To illustrate more clearly just how this fixed batch size influences the cost of hauling, let us use the following comparison since we find that in many sections first class batch trucks with drivers can be rented at the following hourly rates:

TABLE I

1-batch trucks	$1.00
2-batch trucks	1.50
3-batch trucks	2.00
4-batch trucks	2.50

These price rates, of course, vary from time to time but in general about this ratio will be maintained between the rental rates of the various sizes. On well managed jobs the time constants for these trucks, that is, the average time spent in the loading plant plus the time spent at the mixer, may be expected to be for each trip about as shown in table 2: when the mixer operates on a cycle of 90 seconds. It must be understood, however, that these are average values based on about 100 jobs and



The Rather General Use of the "Gob Box" and Mechanical Spreaders in Plant-Mix Bituminous Work Has Greatly Increased the Productivity of the Large Trucks, Especially on Short-Haul Work.

The Truck Produces Useful Ton-Miles Only When Loaded and in Motion Toward Its Destination. A Straight Drive Through the Loading Plant Will Help to Reduce the Necessary Non-Earning Time.

that even on well managed individual jobs these values may vary as much as 25 percent.

TABLE II

	Minutes
1-batch trucks	4
2-batch trucks	8
3-batch trucks	12.5
4-batch trucks	17.5

Under the ordinary conditions usually found on most paving jobs the average round-trip hauling speed of these trucks, assuming all to be in good condition, will not be appreciably different for any of the above sizes. For purpose of this illustration all trucks will, therefore, be assumed to travel at the same average round-trip speed for similar lengths of haul.

For a short haul of about ½-mile we may assume an average round-trip speed of 15 miles per hour. Each truck will then spend four minutes in actual travel on the road. The amount of time required for a complete round-trip by each class of vehicles will then be as follows:

TABLE III—HALF-MILE HAUL AT AVERAGE ROUND-TRIP SPEED OF 15 MILES PER HOUR

Size of truck, batches	1	2	3	4
Time on road, minutes	4	4	4	4
Time at yard and mixer, minutes	4.0	8.0	12.5	17.5
Time per round trip, minutes	8.0	12.0	16.5	21.5
Time per batch, minutes	8.0	6.0	5.5	5.4
Cost per batch (based on continuous operation at 100% efficiency), cents	13.3	15.0	18.3	22.5

It is thus seen that at the above assumed rather fair relative rental rates for batch trucks in good condition provided with capable drivers, and under the above assumed conditions of all trucks in continuous operation at 100 per cent efficiency on a haul of ½-mile, the large trucks are under a progressively increasing handicap. In actual practice the divergency may readily be considerably greater because continuous operation at this degree of efficiency is practically unattainable as well as because of the difficulty in maintaining the number of trucks on the job in an exact balance with the demands of the mixer. For as the haul distance decreases the required supply of hauling equipment also decreases. But to remove a truck decreases the supply rate by the number of batches carried by the truck. Thus given an exact balance with the demands of the mixer when, say, 4-batch trucks are used, then when the haul distance decreases successively in demand by one, two and three batches a truck cannot be removed until the haul distance has decreased the equivalent of four batches. The small truck is free from this handicap.

As the length of the haul increases the relative handicap of the larger trucks in batch hauling however becomes less and less important. In fact, unless the management is of a high grade and other conditions are favorable the difficulty in securing, supervising and keeping properly synchronized the operation of the very large number of small trucks required to supply the demands of the mixer on very long hauls may be, and apparently frequently is, more than sufficient to overbalance their other advantages.

Thus, on a 5-mile haul, given the same conditions and time constants as in the first illustration, except that on this 5-mile haul we may well expect the average round-trip speed to be about 25 miles an hour since the hauling road is in good condition with moderate grades and curves. The four sizes of trucks would then compare as follows:

TABLE IV—5-MILE HAUL AT AVERAGE ROUND-TRIP SPEED 25 MILES AN HOUR

Size of trucks, batches	1	2	3	4
Time on road, minutes	12	12	12	12
Time at batching plant and at mixer, minutes	4.0	8.0	12.5	17.5
Time required for round trip, minutes	16.0	20.0	24.5	29.5
Time per batch, minutes	16.0	10.0	8.2	7.4
Cost of hauling per batch (based on continuous operation at 100% efficiency), cents	26.7	25.0	27.2	30.8

Under these conditions we find that for a 5-mile haul there is considerably less difference in the actual hauling cost per batch and factors other than the apparent cost differential may therefore well determine the choice of the size of vehicle most advantageous to use. Such factors as ease of supervision, general reliability from breakdown or general availability may thus reasonably determine the choice. The only fly in the ointment is that relatively few road paving jobs have an average haul-distance of as much as 5 miles. In fact, the average length of haul on 100 concrete paving jobs was found to have been about 2.75 miles.

Time Losses Due to Faulty Hauling Operations

The function of the hauling equipment on a portland cement concrete pavement construction job is simply to transport at a rate determined by the mixer the desired materials from a stationary batching plant to the mixer at the point on the road where the pavement is being laid. To perform this function effectively should not be very difficult; and yet, the hauling is in general the most inefficiently conducted operation in portland cement concrete pavement construction. Careful studies on more than a hundred paving jobs covering several years indicate that of the time during which the construction crew is actually out on the job and trying to work, an average of about 8 percent is lost by the mixer because of faulty operation of the hauling equipment and an insufficient supply of such equipment. On individual jobs this time loss ranges from as low as 1 to as high as 20 percent. This time loss imposed on the mixer by the hauling frequently forms more than one-half of the total time lost by the mixer during working hours and is aside from all operating inefficiency within the hauling organization itself.

The difficulties encountered in the operation of the hauling equipment on portland cement concrete work, however, do not apply with the same force to the operation of the hauling equipment engaged on plant-mix bituminous paving work. Here we find that the supply and operation of the hauling equipment is charged with causing on the average a loss to the mixing plant of only about 5 percent of the actual working time and varies on individual jobs from nothing to about 10 percent. This is only a little more than one-half as large a time

loss as is imposed by the batch trucks in portland cement concrete paving work. Furthermore, while large trucks are very generally used in hauling the mix to the road the time constant is usually about one-half as large as for batch trucks of corresponding capacity when engaged in portland cement concrete work.

The reasons for these substantial advantages in favor of hauling equipment operation in bituminous paving work are not difficult to find. Much of it is due to the rather general use of a "gob-box" of sufficient size to hold at least a full load. This practically eliminates any necessity for the trucks to wait while additional batches are being mixed to complete the load. Furthermore, only two loading stops are required, at the "gob-box" and then at the scales, as against the usual 3-yard stops in portland cement concrete work. Thus the full capacity load, whatever the size of the truck, can be taken on and weighed in about the same time as is required to load out a 1-batch truck in portland cement concrete work. The present general use of spreader boxes and mechanical finishers or spreaders has also reduced the unloading time, as well as practically eliminated the necessity for any appreciable waits for permission to unload. The net results are that the total time constant of the hauling trucks on the average bituminous paving job usually is about 6 to 8 minutes, or approximately half of that for portland cement concrete batch trucks carrying corresponding loads.

Increasing Size of Batch

These developments in the bituminous field would seem to indicate that the hauling costs in portland cement concrete paving work might also be materially reduced by a substantial increase in the size of the present batch. A batch double the present size could be loaded out and dumped in approximately the same time as the present standard batch. This would reduce the average time constant of the present 2-batch truck from 8 minutes to about 4, and the present average time constant for the 4-batch truck from 17.5 minutes to about 8. Since a large mass of data indicates that the average haul on concrete paving jobs throughout the nation is less than 2.75 miles, most hauls are within the limits wherein the cost of hauling is materially affected by the length of the time constant.

Doubling the size of the present batch would of course require an enlargement of present portable plant batchers and possibly also of bins. But this would involve nothing new or difficult. Batchers of even greater size are rather generally used on many stationary plants. The greatest change would have to be in the paver. While the current 27E paver has been shown to be capable of handling a batch of about 34 or 35 cu. ft., this is probably its present limit. However, from our present knowledge and experience with large plant mixers there should be no serious difficulty in designing a paver capable of producing a 60 or 70 cu. ft. batch within about the same time cycle and of just as excellent quality as the present standard paver. Experience with two pavers on the same job, both in tandem and in parallel, have already shown that the placing and finishing would present no difficulties. On the other hand, we have the definite knowledge that such a development would materially reduce hauling costs and should also materially reduce mixing and placing costs. With the increasing competition between types of pavement this question of using a larger batch appears to be about due to receive earnest consideration.

Batch Hauling Inefficiently Managed

In present paving work the batch hauling is frequently found to be the least efficiently managed operation on the job. This is especially true where the hauling is by individual truck owners on a batch-mile basis. Here the contractor's efforts are usually directed simply toward maintaining such a large oversupply of trucks on the job that the occurrence of any lack of batches at the mixer becomes only the remotest possibility. During the past few years this has usually been easy to accomplish. The final results have, however, frequently been demoralizing to the truck owners and in the end unnecessarily costly to the main contractor. Having plenty of batch trucks strung along and waiting ahead of the mixer is no certain insurance against mixer delays. These trucks must maneuver, back into the skip, dump their batch, and move away. Lack of training or carelessness, or both, means frequent minor delays to the mixer. These delays mean nothing to the truck owner who knows that on his return he will have to wait anyway before he can unload, but to the main contractor each minute caused from such interference represents a definite loss in the neighborhood of 60 or 75 ct.

Even where the contractor provides his own hauling equipment its actual operation is frequently sur-

Eighteen 3-Batch Trucks Waiting to Be Loaded. A Breakdown or Service Failure at the Batching Plant Is Just as Expensive as One at the Mixer.

prisingly inefficient. Great stress is usually laid on keeping a plentiful supply of batches available at the mixer and on efficient truck operation in unloading so as to prevent mixer delays. This is all very well, but the mixer end is only one part of the hauling operation. The same attention should be given to the orderly and efficient passage of the vehicles through the batching plant and to their journey over the road. Care should first be taken in so planning the plant and yard layout that the route of the vehicle through it will be as direct and easy as it can possibly be made. Every delay whether from unnecessary travel, backing, turning or stopping, is added to each vehicle every time it passes through the yard. During the life of the job even very small items can accumulate to a surprisingly large total.

Competent Foreman Needed

The batching plant and materials yard should be in charge of a competent foreman. A definite tally or record system should be provided and every driver provided with a ticket on which is indicated the time when he reaches the yard, when he leaves, and corresponding entries at the mixer. This is one of the most effective ways known for preventing the trucks from bunching and for weeding out careless drivers. The road through the plant and to the main road should be constantly maintained in good condition. The plant foreman should be made responsible for seeing that the trucks are serviced and inspected regularly and constantly maintained in good condition. Some of these things may seem small, but in batch hauling it is this attention to details which often represents the difference between efficiency and inefficiency in the operation of the hauling equipment. The management may provide sufficient vehicles, good drivers and an abundant supply of materials, but unless these so-called minor details are carefully and constantly observed in actual practice real efficiency in the operation of the hauling equipment as a transportation agency will almost certainly be lacking.

Even the Cement Can Sometimes Be Delivered from the Mill.

Subletting the Hauling

The tendency to sublet the hauling or to hire individually owned trucks with drivers on a ton-mile or batch-mile basis is apparently increasing, although no completely satisfactory basis for such contract hauling has as yet been devised. The conditions controlling operating efficiency on this type of work seem to establish a conflicting or opposing set of interest between the two parties. The interest of the hauling contractor is to have on the job the smallest possible number of trucks which can transport the materials at the average rate demanded by the mixer. Any excess truck capacity simply means reduced net earnings. But the mixer, whether concrete or bituminous, never works at a continually uniform rate for any extended period. Furthermore, mixing time, mechanical and other definite conditions, strictly fix the maximum rate which cannot be exceeded. But from time to time for longer or shorter irregular intervals this maximum rate is usually attained by the mixer. However, to permit the attainment of this maximum possible rate the hauling equipment supply must be fully sufficient to handle this maximum production rate as and when it is called for by the mixer. This means that there will be an oversupply of hauling units for all periods during which the mixer is working below maximum capacity. But idle or waiting trucks on the job means decreased profits to the hauling contractor without any penalty to the main contractor. On the other hand, lack of sufficient trucks to keep the mixer operating at maximum capacity, whenever it can do so, imposes no automatic penalty on the hauling contractor, but does inflict a direct loss on the main contractor, which loss frequently amounts to as much as 60 to 75 ct. per minute of mixer delay.

Conflicting Interests of Main Contractor and Hauling Contractor

The interest of the main contractor is therefore to have an oversupply of trucks sufficient to insure him against any delay from this source while it is to the direct interest of the hauling contractor to supply only the average or slowest general rate of the mixer so that all trucks can be maintained in constant operation at maximum capacity. To fully reconcile these conflicting interests is probably impossible. In portland cement concrete a partial solution, which has been tried with apparent success by some contractors, requires that the hauling contractor maintain only a truck supply sufficient to deliver the average hourly demand of the mixer for each particular daily haul while the main contractor provides sufficient trucks from his own supply to meet the additional demands of the mixer over and above the average. Under this plan the main contractor's trucks are brought on fully loaded as work begins in the morning. Then whenever the hauling contractor fails to have a truck ready as needed, the main contractor's reserve trucks proceed to fill the gap to whatever extent may be necessary. These trucks also supply the last batches at closing time, noon and evening. A reserve of this kind in 1 or 2-batch trucks equivalent to about 10 or 15 per cent of the hauling capacity supplied by the hauling contractor would appear to merit much more study.

As These Two Pavers Operating in Parallel Frequently Poured 115 Cu. Yds. of Pavement Per Hour Per 8-Hour Day, There Can Be No Question That the Production of a 2-Cu. Yd. Mixer Could Not Be Adequately Placed and Finished.

Variations in Hauling Speeds

Actual hauling speeds as observed on the job vary with many conditions, the chief of which are the condition of the hauling road as to surface, grades, curves and widths; the traffic as to kind and density and especially as to the amount of cross traffic, traffic lights and grade crossings; the equipments as to type, size and mechanical condition; and last but not least, with the length of the haul. On short hauls average round-trip speeds are invariably found to be low. This is also true to varying degrees for congested traffic conditions, steep grades, sharp curves and poor mechanical condition of the hauling units. Nor do all the vehicles have to be in poor mechanical condition to demoralize hauling speeds. One or two slow units in the truck supply will be sufficient to materially reduce the average hauling speed of the entire outfit. Tables V and VI illustrate some of the variations in average hauling speeds which are found from job to job as well as from time to time on the same job as road conditions vary and the length of haul increases or decreases. Actual average hauling speeds may be expected to vary, as shown in these tables, from about 6 to over 40 miles an hour.

TABLE V—EFFECT OF LENGTH OF HAUL ON AVERAGE ROUND-TRIP SPEED FOR VARIOUS SIZES OF TRUCKS

Size of Trucks and Road Condition	Length of Haul, Miles	Average Round-Trip Speed, Miles Per Hour
Good pavement; 3-batch trucks in excellent condition	1.58	27.1
	1.81	27.5
	2.04	28.3
	4.35	33.7
	4.97	37.2
	6.24	40.2
Earth, gravel and pavement in fair to poor condition; 3-batch trucks in fair condition	0.66	7.2
	0.95	8.1
	1.20	8.2
	1.78	8.7
	2.08	10.8
	2.30	10.4
Earth and gravel road in fair to poor condition; 2-batch trucks in fair condition	0.18	6.0
	0.46	10.9
	1.17	16.5
	1.73	17.4
Earth road in fair condition; 1-batch trucks in fair condition	0.52	9.8
	0.80	11.4
	1.02	13.1
	1.48	15.8
	1.87	16.5
	2.45	17.1

TABLE VI—COMBINED EFFECT OF LENGTH OF HAUL AND ROAD CONDITION ON AVERAGE ROUND-TRIP SPEED

All 1½-ton trucks in good condition

Condition of Road	Length of Haul, Miles	Average Round-Trip Speed, Miles Per Hour
Fair	.35	10
Fair	.55	14
Good	.95	21
Spongy and rutted	1.15	15
Good	1.45	24
Very good	1.65	31
Spongy and rutted	1.80	18
Good	2.40	27
Fair	2.60	21
Good	2.80	28
Fair	2.90	24

Formula for Determining Number of Trucks Required

For determining the number of trucks required at any given time the following formula is suggested:

$$N = \frac{120L}{nSt} + \frac{T}{nt}$$

where N = number of vehicles to just keep up with the mixer when in continuous operation.
L = length of haul in miles.
T = time constant of hauling vehicles in minutes.
S = average speed of hauling vehicles in miles per hour for round trip.
n = number of batches carried by vehicles per load.
t = length of mixer cycle in minutes.

The formula gives the number of vehicles needed to just meet the demands of the mixer when in continuous operation with a cycle of t-minutes in length. When these conditions prevail the formula gives the number of vehicles necessary to maintain operation without any reserve for accidental truck delays. Contractors usually find it advisable to provide a slight oversupply—generally about 10 per cent—as an insurance against such accidental delays, especially when the haul is long or road conditions poor.

The factors involved are all readily obtainable. The length of haul (L) is readily ascertained. The time constant (T) which should include all regular stops and delays, the mixer cycle (t), and the average round-trip speed (S) of the hauling vehicles should all be secured from direct stop-watch readings. These stop-watch readings should be made frequently and checked from time to time as conditions and distances change.

EMPLOYE OR INDEPENDENT CONTRACTOR?

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ONE of the chief questions that arises in applying the Unemployment Compensation provisions of the Social Security Act, is the question: "Who is an employe." The answer is far from being the simple matter it may appear.

There is, for instance, the question whether workers in borderline employments are exempt. Is a nurseryman exempt as "agricultural labor"? When the question was first raised, there were no rulings. Now the Revenue Bureau has said nursery employes are not exempt under the "agricultural labor" classification.

Where is the borderline on government employment? The answer is quite simple with respect to port authorities and power districts. They are political subdivisions and have been so held. (S.S.T. 94, 98). It is not so easy to decide when some organization is exempt as an "instrumentality of government." For example, state banks may or may not be considered instrumentalities of government depending upon state laws, but the Federal government has ruled that state banks which are members of the Federal Reserve are instrumentalities and therefore exempt. Employes of city-owned and operated lighting plant, waterworks or cemeteries are government employes and exempt (S.S.T.—2); but employes of a private company operating a municipally owned gas plant under lease, are not exempt as governmental employes. (S.S.T. 89).

A public corporation, which is wholly owned by a county and a city in a certain state and which operates ferries in that state has also been held to be exempt governmental employment. (S.S.T. 74)

Such exemption does not extend, however, to contractors on government work. A company operating under PWA and state highway contracts financed by relief funds, and using local labor certified to it by the National Reemployment Service, is not an instrumentality either of the Federal government or of a state. (S.S.T. 14)

Again, it was held that whether the services of individuals employed on Federal relief projects are excluded . . . depends upon whether the services are performed in the employ of the Federal government, an instrumentality thereof, a state, a political subdivision thereof, or an instrumentality of a state or political subdivision, or in the employ of a private contractor who hires and pays the individuals working on the project. The fact that such a private contractor is engaged in the performance of contracts in connection with Federal relief activities does not relieve him from liability for the tax. (S.S.T. 26)

The greatest difficulty occurs, however, in determining when a worker is not an employe but an independent contractor. The Act states very clearly that an "independent contractor" is not an employe for any purpose. The Act also sets up certain mile posts of definition, but the facts of a given case never seem to fit neatly into the definition. Many of the state laws admit the inadequacy of definition by saying each case is one for the commission to decide on the facts.

The essence of the employer-employe relationship is that the person for whom the services are performed has the right to control and direct the individual, not only as to the result to be accomplished by the work but also as to the details and means by which that result is accomplished. That is, an employe is subject to the will and control of the employer not only as to what shall be done, but *how* it shall be done.

If such control exists, the designation or description of the relationship by the parties as partner, coadventurer, agent, independent contractor, or anything other than that of employer and employe is immaterial. It is also immaterial by what measurement, method or designation the compensation is made, if the relationship of employer and employe in fact exists. In fact the relationship may exist even though no wages nor compensation be paid. The Bureau of Internal Revenue (S.S.T. 33) has held:

"While the measure of the tax imposed is the total wages paid by the employer *there is no provision* in the Act or regulations under which it is necessary that wages or other remuneration be paid to an individual rendering services for another in order for such individual to be an 'employe' within the meaning of the Act . . . the fact that such individual receives no salary or remuneration is not material in determining whether he is to be regarded as an employe."

Entering into a contract calling a man an independent contractor, does not make him such, if you reserve such control over him as to make him *in fact* an employe.

The degree of control which establishes the employe relationship is a matter of the preponderance of the evidence in a number of tests such as: source of ultimate control; right to select own assistants; ultimate source of wages; ownership of tools and other equipment; right of terminating contract; relative freedom as to working conditions; whether the work to be done may be delegated by the particular worker to others; and whether the individual whose status is in doubt engaged in a distinct and independent trade, business or occupation.

The Federal and state laws include in their definition of employment "services performed under a contract of hire."

A "contract of hire" is a legal entity establishing the relationship of "master and servant." Some of the statutes leave it at that and let legal analysis determine when the relationship of "master and servant" exists. Some of the states, however, has not only specifically excluded the "independent contractor," but have defined it as follows:

1. That such individual has been and will continue to be free from the employer's control and direction over the performance of his work both under his contract of service and in fact;

2. That such work is either outside the usual course of the employer's enterprise or performed outside of all the employer's places of business;
3. That such individual is customarily engaged in an independently established trade, business, profession or occupation.

Therefore, it is necessary to weigh every fact of a given case by the basic rule of "master and servant" control, or the independence of an independent contractor.

Then the contract must set out the facts of the relationship clearly.

Another provision of the Social Security Act which must be closely watched is that upon liability for the employes of other. There are two possible instances of such liability: (1) in the case of employes, of helpers, or of assistants, etc.; (2) in the case of employes of subcontractors. There is no provision in the Federal law stating such liability, but it is a factor in state laws.

Employes of a branch office, or of a supervisor are employes of the owner of the business. (S.S.T. 35.) They are, in short, employes of an employe, and therefore employes under the definition.

The Bureau of Internal Revenue has also ruled that employes performing services under the direction of "B," an employe of the M Company, in a department of the company supervised by "B," are employes of the M Company within the meaning of Titles VIII and IX of the Social Security Act, even though such employes do not appear on the company's payroll and are paid by "B" out of the gross amount received by him from the company measured by the number of units produced in his department. (S.S.T. 70.)

This is not true in all states, however, unless by rulings of the commissions in those states.

The original draft of the Federal Social Security Act contained a provision which was deleted from the Federal Act as passed, but appears in substantially the same form in state laws—

> "In determining whether an employer employs enough persons to be an 'employer' subject thereto . . . he shall whenever he contracts with any subcontractor for any work which is part of his usual trade, occupation, profession, or business, be deemed to employ all persons employed by such sub-contractor on such work, and he alone shall be liable for the tax measured by wages paid to such persons for such work except as any subcontractor, who would in the absence of the foregoing provision be liable to pay said tax, accepts exclusive liability for said tax under an agreement with such employer made pursuant to regulations, etc."

Such a clause appears in the state laws of: Alabama, Arizona, Colorado, Idaho, Iowa, Louisiana, Maryland, Massachusetts, Mississippi, New Mexico, New York, North Carolina, Oklahoma, Oregon, Rhode Island, South Carolina, South Dakota, Texas, Utah, Virginia, Wisconsin.

Contractors in those states must safeguard themselves accordingly, or they may find themselves liable for the taxes of the subcontractor.

The determination of "employment within the state" is another troublesome problem for employers having mobile crews working in several states. If a majority of the work is done in one state, the employment is "localized" for tax purposes in that state. But when the majority of the employment does not occur in any one state, the determination of liability follows a general formula. If some of the work is performed in a state and the headquarters are in the state, the employment is "localized" for tax purposes in that state. If the headquarters are not in a state where some of the work is performed, but the employe's residence is in the state, the employment is "localized" for tax purposes where the residence is.

So far there has been no Federal ruling upon division of liability for construction crews, but Indiana has ruled that the supervisors sent from the home office are not in Indiana employment, although the local men employed on the construction are. If this ruling is generally adopted elsewhere it is a reasonable one which may well be, it will be necessary for contractors to keep their records in such form that the supervisory labor from headquarters can be easily separated from the local labor payrolls for tax reporting.

Of course, the controlling factor is place of employment. A crew which spent the greater part of the year on a job in a certain state, would undoubtedly be reported for tax purposes entirely in that state. Even the supervisory staff might then be "localized" in the state, unless other factors such as: place where contract of hire was made or exemption of casual or seasonal labor, entered into the decision. Three states, Kentucky, Louisiana, South Carolina, stress place where contract was made and give it precedence over either headquarters or residence in "localizing" employment.

▼

Erosion Control Measures Will Be Used on Highways

Erosion control measures developed for farm lands will be used to protect sections of state and federal-aid highways this year under plans now being worked out between 19 state highway departments, the Bureau of Public Roads and the Soil Conservation Service.

A recent survey in Wisconsin showed erosion responsible for much of the cost of highway maintenance in certain parts of that state. Uncontrolled soil erosion also increases maintenance costs on federal-aid roads, according to officials of the Bureau of Public Roads.

Under the proposed program, state and federal officials will select short stretches of right-of-way along highways within the boundaries of Soil Conservation Service areas. The service will furnish technical supervision, labor and necessary planting materials. The state will supply construction material and equipment, and agree to maintain the work for five years.

Actual operations to protect highway cuts and fills, highway ditches, and drainage structures, have been started in some of the 19 states. Vegetable control measures will be used wherever possible, although some construction work will be done where gullies are menacing adjacent farm lands.

States that have established roadside erosion control relationships with the Soil Conservation Service are: Alabama, Arizona, Arkansas, Georgia, Idaho, Illinois, Indiana, Maryland, Mississippi, North Carolina, Ohio, Oregon, South Carolina, Texas, Utah, Virginia, Washington, West Virginia, and Wisconsin.

▼

NEW MEXICO START 2-YEAR CONSTRUCTION PROGRAM.—The state highway department of New Mexico is planning a 2-year construction program that will result in completing principal highways of the state and construction of secondary roads. A $10,000,000 road debenture issue will be sold and the funds obtained will be used to match federal aid funds for main highways and secondary roads and for the construction of state roads.

PREFORMED WIRE ROPE

A Factor in Reducing Equipment Operating Costs

By

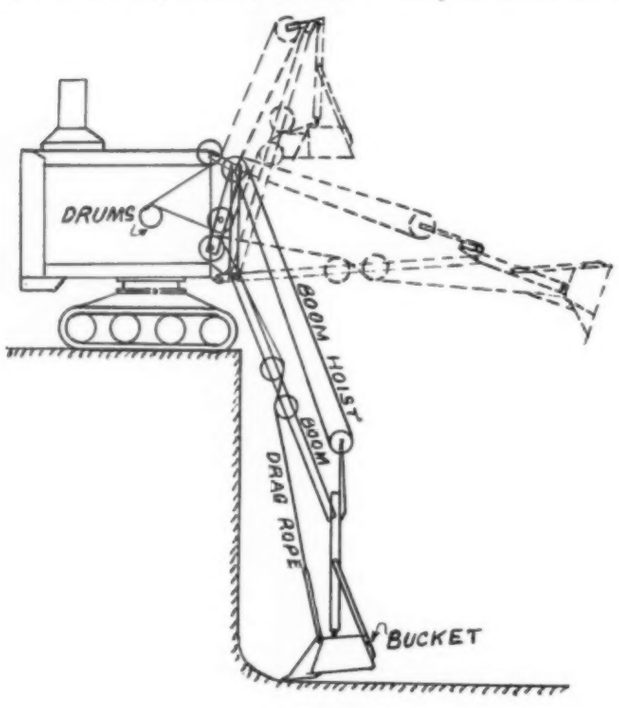
JAMES F. HOWE, M.E.

Chief Wire Rope Engineer, American Steel & Wire Company

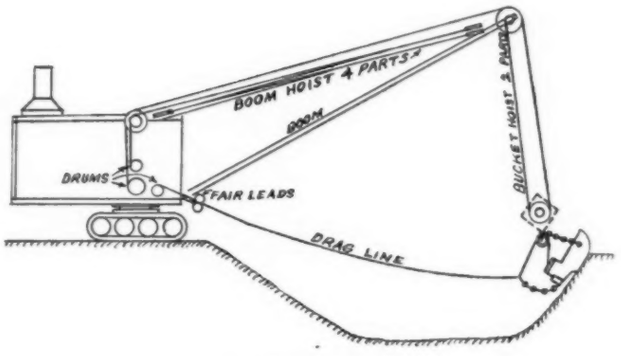
THE increasing popularity of preformed wire rope among wire rope users in general is noteworthy, and is due almost entirely to the improved service which the preformed wire rope is giving as compared to standard wire rope. Hence, an analysis of the principal factors which are responsible for this condition will be interesting to all rope users, those who use ordinary or standard wire rope and those who have adopted the use of preformed wire rope.

Before going into a discussion of preformed wire rope, let us consider the characteristics which pertain to the manufacture of both standard wire rope and preformed wire rope. To begin with, the same kind of material is used in the manufacture of either type. This material, in any of the grades such as cast, mild plow, plow, or improved plow steels, is a material possessing fairly high strength; and it is somewhat stiff and lively when bent or formed, and does not feel or act like annealed wire.

The process of rope making requires that the wires which are made into strands, and the strands which are laid into a rope, be so manufactured, stranded and laid into the rope that the wires are practically free from torsion, individually. This has been a fundamental of rope making for many years. When two pieces of rope, one standard and the other preformed, are lying side by side on a reel, it is impossible to tell the difference between the two, from observation. They have the same lengths of lay, the same sizes of wires, the same wire strengths, and the same general combinations of wire sizes; and both are equally flexible for bending around sheaves.



Back Digger



Dragline Excavator

Preformed wire rope possesses, in addition to these common properties, many additional valuable characteristics:

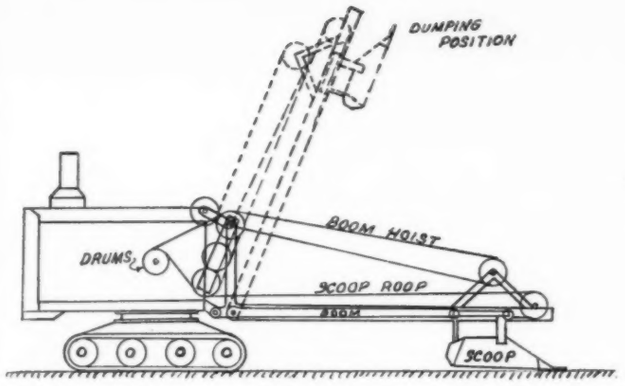
It is free from the natural forces that are inherent in standard wire rope. It is so constructed that each wire in each strand, as well as each strand in the rope, retains its proper position without restraint of any sort. This results in better distribution of the load over the entire cross-section of the rope structure.

Preformed wire rope may be readily cut without applying seizings to the rope, and there is no appreciable untwisting of the rope structure. Standard wire rope, on the other hand, must be tightly seized on the ends to prevent the lay from opening up or running out.

When bent around a sheave, preformed rope will have only those forces brought into play which induce pure bending stresses. No unseen forces are added to those to which the rope itself is subjected. For this reason, increased wire rope wear is obtained in service before the wires start to crack from fatigue due to bending.

Due to the natural spiral wave in the wires and in the strands, preformed wire rope is free from twisting tendencies, and thus practically eliminates kinking, which is likely to injure a wire rope particularly during installation. Furthermore, when this type of rope is loaded, it will exhibit fewer twisting tendencies than standard wire rope. This makes it desirable for ropes with wire centers and Lang lay ropes of every construction. This latter type of rope, when not preformed, causes trouble, frequently, by untwisting.

Preformed wire rope is much easier to splice than standard rope, due to the fact that the preformed spiral of the strand slips naturally into its proper place when splicing. One point should be observed in splicing a preformed rope, and that is to make sure that the ends of the strands which are to be tucked are straightened



Skimmer Scoop

out before the tucking operation. These tucked ends should be taped and run into the rope for a reasonable distance, preferably for a somewhat greater distance than in the case of standard wire ropes.

Preformed wire rope will more easily maintain its circular cross-section when used under severe crushing conditions, which makes it most adaptable for smooth and even winding on the drums of hoisting equipment. This eliminates uneven wear and rapid deterioration of the rope from irregular drum winding.

When broken wires begin to develop, which must occur eventually in any type of rope, wires of preformed ropes remain in place, whereas the wires of standard ropes stick up and porcupine. Hence, any broken wires in preformed rope will not cause excessive wear on the drums and sheaves, nor will they bend over and cause the fracture of adjacent wires. When in this condition, preformed rope is safer for workmen to reeve and handle. Because every individual wire is preformed identically, as is also the case with each strand in this type of rope, high or low strands cannot develop through unequal loading of the wires or strands. Also, this unbalanced condition cannot develop through the slipping or turning of strands because even without seizings these strands and wires remain in their proper symmetrical positions as manufactured. This, of course, is not true of standard ropes, in which the wires and strands more easily become displaced, or permit slack to slip back from the ends unless sufficiently tight seizings are used.

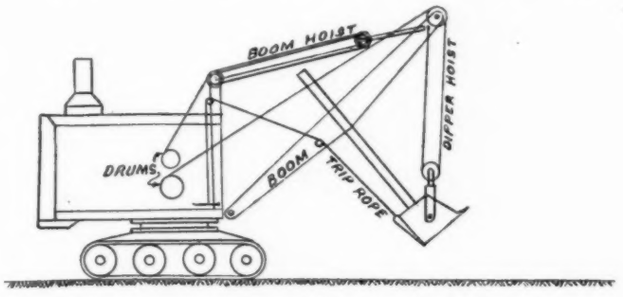
Should preformed wire rope be accidentally overloaded and break, both pieces can be salvaged, whereas standard wire rope will untwist for a considerable distance, thus spoiling it for future use.

The summation of all of these factors results in increased wire rope life in sufficient amount to materially reduce wire rope costs to the user.

Since the advent of preformed wire rope, and its usage on road construction and for general contracting, there has resulted an increased wire rope life on the smaller shovels, draglines, and machinery used for the construction of roads, streets and bridges. This increased service has enabled the contractor to secure greater efficiency from his equipment; and has been equally welcome to the operators of such equipment, since it has meant less work for them in installing, handling, and changing wire rope. It is true, in every case, that the shutting down of a piece of equipment for the changing of a wire cable means a rush job to get the old cable off, the new cable on, and the equipment going again. This is much harder work than operating the equipment after the cable has been put on.

Installations where preformed rope construction will give greatest value may be summarized as follows:

Dipper Hoist Ropes, Dragline Ropes, Drag Bucket Hoist Ropes, Clamshell Holding and Closing Ropes, Digging Ropes on Trenchers, Operating Ropes on Pavers, Concrete Mixers, Scrapers, Cranes, Derricks, etc.



Power Shovel

There are also many other places where preformed rope may be used and excellent results obtained. Those noted above are merely the principal uses.

Although preformed wire rope is sold at a slight premium over standard wire rope, it is evident from the foregoing that this slight increase is justified, especially for the type of equipment used by road constructors.

▼

PAINT SAFETY SLOGANS ON STREET—Traffic safety slogans have been painted on several streets in Washington, D. C. The slogans read: "Don't Be a Traffic Cheater—Give the Pedestrian His Right of Way." These are painted in the streets. Similar slogans, addressed to pedestrians and painted on the sidewalk, read, "Give the Motorist His Right of Way." If the slogans prove helpful, it is planned to paint them on many intersections.

▼

Miscellaneous Equipment Operating Costs in Illinois—1936

The following table is from the records of the Illinois Division of Highways. It shows not only the direct cost per hour (exclusive of operators' wages) for each of the eight machines, but also the quantities of fuel and lubricants consumed, and the original cost of the machines:

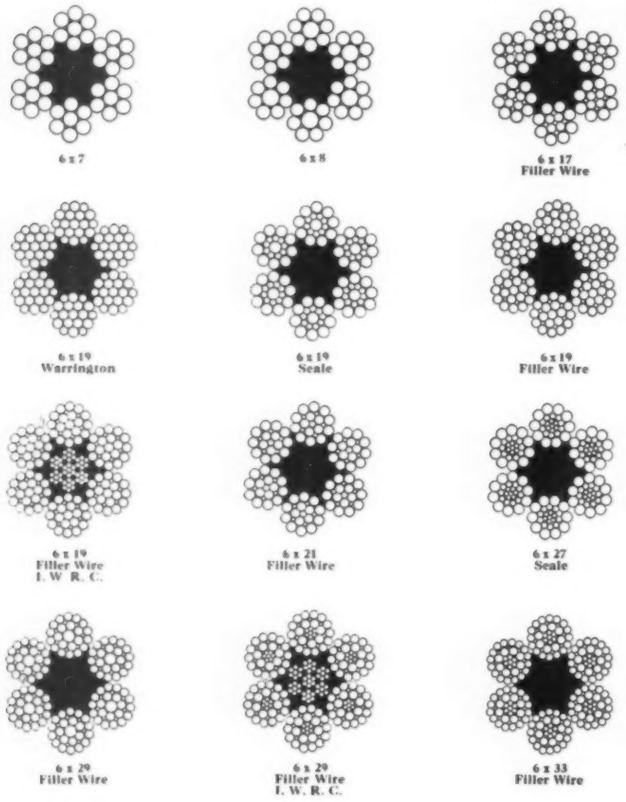
DIRECT OPERATING COST OF EQUIPMENT DURING 1936—OPERATOR'S WAGES EXCLUDED

Machine	Age, Years	Size	Cost	Hours Worked	Fuel, Gals.	Oil, Gals.	Grease, Lbs.	Field Repairs, Parts and Labor	Direct Cost per Hour
Blade Grader (hand cont.)	1	12 ft.	$1,868.48	555	....	....	97	$ 6.90	$0.0532
Blade grader (hydraulic)	1	12 ft.	2,281.05	491	142	14¾	54	6.30	0.0848
Crawler tractor (gasoline)	7	60 hp.	4,432.36	1,002	4,220	99¾	317	33.10	0.7283
Crawler tractor (Diesel)	2	50 hp.	4,865.37	1,127	2,183	57	338	16.62	0.1810
Crawler tractor (gasoline)	3	35 hp.	2,431.00	912	1,884	56½	197	15.92	0.3660
Shovel (gasoline)	1	½ yd.	5,469.13	905	1,490	33½	98	75.68	0.4834
Finishing machine	7	18 and 20 ft.	3,322.65	427	283	5½	58	10.08	0.1309
Paving machine	6	27-E	8,209.24	434	1,863	31	79	23.64	0.7044

Some Practical Notes

ABOUT WIRE ROPE

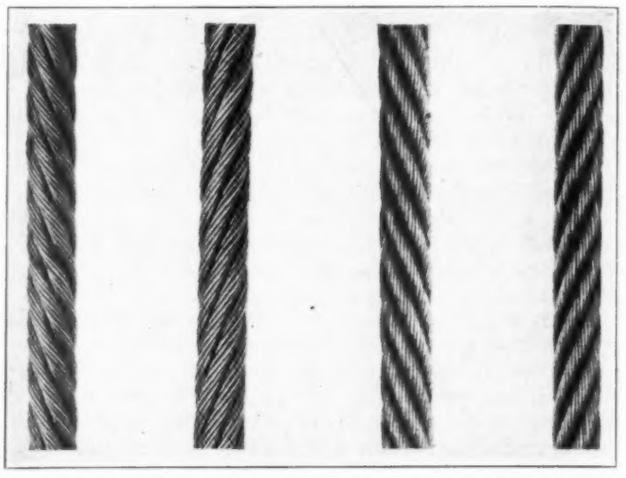
ON OTHER pages in this issue is a discussion by Mr. James F. Howe on the advantages and uses of preformed wire rope. The editor offers this additional information which was taken from the Wire Rope Users' Handbook of the American Cable Company, in order to demonstrate with additional force the difference in types of ropes. Practically all wire rope manufacturers now make both preformed and ordinary wire rope. The photographs and drawings accompanying these remarks are presented to give a visual perception of the difference in rope designs and rope construction. Because there are so many designs available, the economic rope to use for a particular installation should be as recommended by wire rope engineers. There are cases where standard wire rope is more economical and advantageous and places where preformed


6 x 7
6 x 8
6 x 17 Filler Wire
6 x 19 Warrington
6 x 19 Seale
6 x 19 Filler Wire
6 x 19 Filler Wire I. W. R. C.
6 x 21 Filler Wire
6 x 27 Seale
6 x 29 Filler Wire
6 x 29 Filler Wire I. W. R. C.
6 x 33 Filler Wire

Cross Sections of Various Constructions of Wire Rope. These Are the Ones Most Frequently Used.

wire rope should be used. Engineers who have specialized on wire rope installations and economics should be consulted whenever any quantity of rope is required.

Ropes are layed (we might say "woven," in common language) in two general classes, viz., Lang Lay and Regular Lay. Both preformed and ordinary or standard ropes are built in these two classes. Each one of these classes of weaving have a Left Lay construction and a Right Lay construction. The accompanying picture shows these constructions. Ordinary or standard Lang Lay ropes, whether left lay or right lay, have always been hard to handle, as they are much more readily kinked or "bird-caged." Preformed Lang Lay ropes



Left Lay Lang Lay | *Right Lay Lang Lay* | *Left Lay Regular Lay* | *Right Lay Regular Lay*

overcome these objections. One precaution that must be rigidly enforced for Lang Lay ropes, whether standard or preformed, is to keep the equipment well grooved so that the tread of no groove is small enough to pinch the rope. Failure to appreciate this point has caused very erratic service with the use of Lang Lay rope on soft, easily worn sheaves.

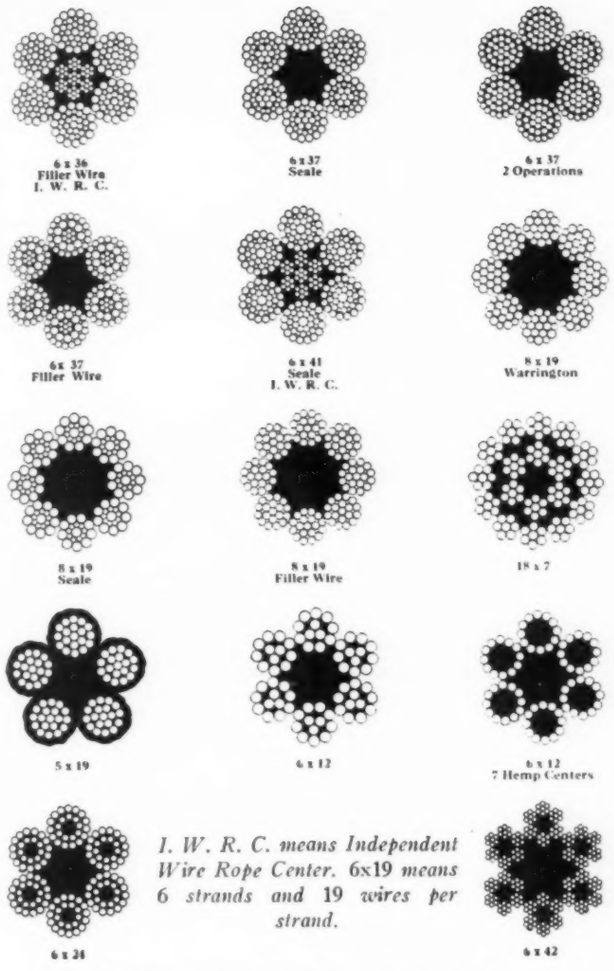
It is further recommended that stiff connections be used on Lang Lay ropes, as the use of swivels causes excessive unlaying (loosening of weaving) of the rope.

Two other accompanying pictures show only about a score of the at least 80 different designs that have been built and used. This is presented to show the reader why a wire rope engineer should be consulted whenever a rope problem is encountered.

Proper Working Loads.—The proper working load of a wire rope for general purposes, particularly running ropes, should never exceed one-fifth of the breaking strength. In other words, a factor of safety of five should be allowed. For example, a 7/8-inch diameter, 6x19 Plow Steel Rope has a breaking strength of 28 tons, hence the proper working load should not exceed 5.6 tons. Naturally, rope for different installations have different factors of safety.

Twisted Strand From Ordinary or Standard Wire Rope

Strand From Preformed Wire Rope



I. W. R. C. means Independent Wire Rope Center. 6x19 means 6 strands and 19 wires per strand.

Cross Sections of Various Constructions of Wire Rope. These Are the Ones Most Frequently Used.

Sheave Sizes.—It is advisable to have sheave and drum sizes that conform to the following:

Average Diameters Recommended

For 6x7 rope, 72 times rope diameter
For 6x19 rope, 45 times rope diameter
For 6x37 rope, 27 times rope diameter
For 8x19 rope, 31 times rope diameter

Minimum Diameters

For 6x7 rope, 42 times rope diameter
For 6x19 rope, 30 times rope diameter
For 6x37 rope, 18 times rope diameter
For 8x19 rope, 21 times rope diameter

It should be noted that larger diameters increase the length of life of the rope. Furthermore, different rope constructions may employ diameters different than these given above as averages for general guides. Wire rope engineers should be consulted when minimum diameter problems are encountered.

Lubrication.—Manufacturers of wire rope build a lubricated core into the rope but through repeated load applications and service this lubrication is gradually expended and it is advisable, even necessary, to make frequent applications of a good adhesive lubricant during service. A dry core will wear and collapse quicker and will absorb moisture to the serious detriment of rope service.

The smaller the sheaves or the heavier the tension on the rope, the more often should the rope be lubricated. A good lubricant retards corrosion of the wire and deterioration of the core, reduced internal friction which is a cause of wire breaking from increased bending stresses, and decreases external wear. The lubricant should be thin enough to penetrate the strands and the core but not so thin as to run off the rope, nor so thick that it merely covers the rope.

Therefore, a thicker, adhesive, semi-plastic compound applied hot in a thinned condition is best whenever possible to obtain. To properly lubricate with a heated lubricant, it is necessary to have the rope run slowly through the heated tank of oil so that the proper penetration occurs. Where this is not possible, an application of a thinner, unheated lubricant will give practical results.

▼

Clearing House on Gas Tax Diversion

A nation-wide clearing house to oppose the diversion of the funds received from the gas tax was recommended by Murray D. Van Wagoner, State Highway Commissioner of Michigan, in a report presented at this year's convention of the American Road Builders' Association.

This would be established through the cooperation of various bureaus, agencies, and organizations including the American Road Builders' Association. Others that come to mind are the U. S. Bureau of Public Roads, American Association of State Highway Officials, American Petroleum Industries Committee, National Highway Users' Conference, American Automobile Association, American Trucking Association, Inc., National Association of Motor Bus Operators, Automobile Manufacturers' Association, National Automobile Dealers' Association, Portland Cement Association, Asphalt Institute, National Association of Paving Brick Manufacturers, Granite Block Association, National Safety Council, New England Road Builders' Association, Association of Highway Officials of the North Atlantic States, American Association of Motor Vehicle Administrators, National Crushed Stone Association, Chamber of Commerce of the United States, National Sand and Gravel Association, National Conference on Street and Highway Safety, Highway Research Board, Highway Education Board, National Petroleum Association, Independent Petroleum Association of America, Western Refiners' Association, National Grange, American Farm Bureau Federation, and others.

This clearing house would be set up on a permanent basis with a paid personnel in charge. The individual members of this clearing house would continue their present work against diversion, but their separate efforts would be correlated and unified through the operation of the clearing house. Periodic meetings should be held of representatives of the various organizations in this clearing house at which time national campaigns and plans could be drafted and decided upon.

"Permanent committees organized along similar lines should be formed in every state in the Union to wage a year-round fight. It is vital that we recognize the need of permanent vigilance and permanent efforts to get rid of diversion rather than sporadic campaigns every two years when our legislatures are in session.

"In other words, we would strive for uniformity and concentration of thought and energy in this fight against a grave national evil. Until we do, it is probable that we shall always have diversion with us."

HYDRAULIC SYSTEMS
AS USED IN ROAD MACHINERY

By H. C. FRENTZEL

Mechanical Engineer, The Heil Company, Milwaukee, Wis.

HYDRAULIC systems have established themselves in the road machinery field because of their simplicity, ruggedness and flexibility. They have been successfully applied to dump trucks, scrapers, rippers, graders, rollers and snow plows, besides in industrial applications such as machine tools, broaches and presses of all description.

The hydraulic system is comprised of the following:

1. A hydraulic pump (attached to the hoist proper or to the rear face of the tractor transmission case).
2. Power takeoff (geared to the transmission or splined at the forward end to fit the power takeoff shaft in the tractor transmission).
3. Control valve
4. Relief valve
5. Hydraulic hoists
6. Oil reservoir
7. A system of hoses or pipes

Their simplicity is due to the few and inexpensive parts required together with the fact that they can be produced with ordinary production accuracies and give good service over a number of years without high service and maintenance costs.

The direction of rotation of the spur gear pump has no effect on its operation if originally designed to operate in either direction. However, double helical gear pumps should only rotate with the apex of the tooth leading as shown in Figure 1c.

For low pressure duty or when only intermittent operation is required grey iron or nickel grey iron spur gears are sometimes used, occasionally these are alloyed with chromium or molybdenum. In this category use of hydraulic equipment, the dump truck is the most common. In continuously operating pumps hardened steel gears, both double helical and spur are used. The spacer, Figure 1d, or housing for the gear, is generally made of grey iron. Alloy cast irons containing nickel either alone or in combination with chromium or molybdenum produce a more uniform and denser casting having good machinability for the increased wear properties they have. The side plates are generally made of grey iron either plain or alloy. In some cases wear plates are placed between the side plates and gears. These may be reversed thus increasing the life of the

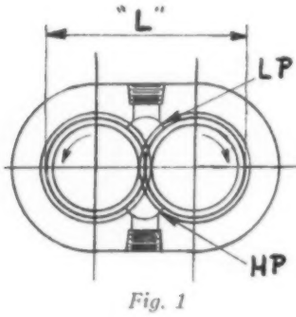


Fig. 1

Fig. 1a

Fig. 1b

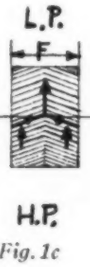


Fig. 1c

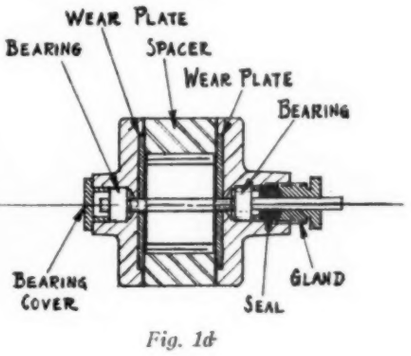


Fig. 1d

By proper selection of pump capacity and cylinder diameter any mechanical advantage, speed and stroke, can be had without impairing the efficiency of the system or adding additional parts to attain high reduction. Furthermore, the same pump can be used to actuate several cylinders either simultaneously or individually. The cylinders need not be of the same size nor stroke.

Pump—The pump is usually of the gear type, most generally of the spur gear construction where low pressures under 600 lb. or intermittent operation is required, such as in dump body work. Where the pump is used for continuous operation or where noise is a factor or high speeds are employed the double helical gear is used. Single helical gear pumps are not so common because they are not as well suited for this type of service due to the side thrust caused by virtue of their construction. In either of these helical types of gears a greater accuracy in the tooth construction and clearances must be held. The bottom tooth clearance especially must be held to a low figure to prevent high slippage losses. This slippage is not a factor in the spur tooth gear design as there is no tendency or possibility of the oil to slip from the high to the low pressure sides through the tooth clearances.

pump before replacements are required. When grey iron gears and side plates run against each other, care must be taken to have different hardnesses in the two. If they have the same hardness within the normal hardness range of these materials they will be found to wear quicker and even seize, regardless of their hardness. It is preferable to have the greater hardness in the gears. On intermittent operation bronze bearings in the pump of ample size are used and have been found to be very satisfactory. Bearing pressure from 250 lbs. per sq. in. of projected area and up are used, depending on bearing and shaft materials. The shafts are generally hardened and ground to take greater horsepower and increase the wear properties. On high pressure continuous operations ball, pin and needle bearings are more applicable. To calculate the load on each of the four bearings multiply the length of the bore in the spacer as shown by letter, L, in Figure 1 by the face width of the gears, F, times the maximum pressure difference between the low and the high side and divide this product by four, since there are four bearings. To this add one-fourth the product of 1.15 times horsepower required (or maximum horsepower for which the pump was designed) by 33,000 and divide by the quan-

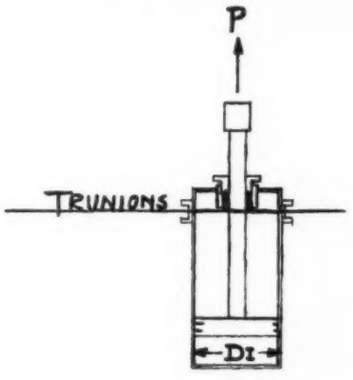


Fig. 2a

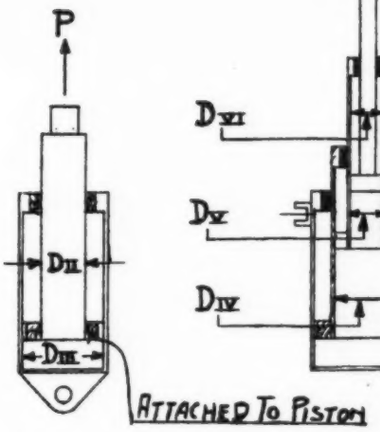


Fig. 2b

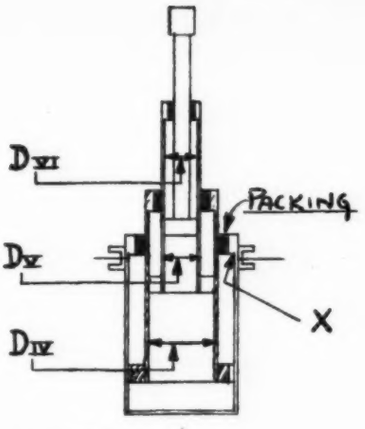


Fig. 2c

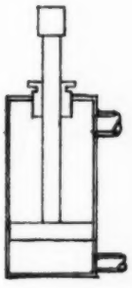


Fig. 2d

tity, pitch diameter of gear $\times$ II (3.1416 $\times$ RPM) to obtain the bearing load due to power transmitted.

Bearing pressure = $\frac{1}{4}$

$$L \times F. + \frac{1.15 \text{ HP} \times 33{,}000}{\text{P.D.} \times \text{II} \times \text{RPM}}$$

To this value a factor of safety for service should be added depending on the application for which the pump is to be used.

The horsepower requirement of a pump can be calculated by use of the following formula:

$$\text{H.P.} = \frac{\text{G P S F}}{33{,}000\text{E}} \text{ or } \frac{\text{E}}{0.000583} \text{ P G (using factors given below).}$$

HP = Horsepower.
P = Pressure in pounds per sq. in.
S = Head corresponding to 1 lb. liquid = 2.637 ft. head for 1 lb. pressure. This is based on a No. 20SAE oil having a specific gravity of approximately 0.875 for a gravity of 29-30 A.P.I.
F = Pounds per gallon.
E = Percentage of efficiency of this system (average efficiencies range from 60 to 80 per cent).

A No. 20SAE oil is generally used in dump body and scraper work, having a viscosity of 125 to 185 sec. at 130° Fahrenheit and a pour point of —20° F. Although heavier or lighter oils are used, the above oil is suitable for all year service. It has sufficient body to lubricate properly and viscosity to keep the pump slippage low but still does not have a high friction resistance in the valve and piping.

The location of the outlets and inlets to the pump are of no serious importance in that the oil can enter from the sides or through the spacer as long as the ports are of ample size and the flow of oil is not restricted. The velocity in the inlet of the pump can vary from 2 to 5 ft. per second in the outlet from 4 to 8 ft. per second. These figures again are based on practice and must be tempered with the individual design and conditions. The vacuum on the suction side should never exceed 5 in. (Hg) on short runs under normal conditions and should have gravity flow to the pump on long runs. Higher vacuums may cause trouble in service due to temperature variations. The oil reservoir should always be at a higher level than the pump. The hoists employed consist of two types, single and double acting. The first type includes piston, plunger and telescopic as shown in figures 2a, 2b, and 2c, respectively.

The type as shown in Figure 2a is the most common and lends itself to both cast iron or steel tube construction. Type 2b is economical to build, especially with steel tubing. The telescopic cylinder, Fig. 2c, combines the design of 2a and 2b. The pushing effort of Type 2a is equal to the pressure of the oil in pounds per square inch times the piston area. In Type 2b it is the product of the oil pressure times the area of dII irregardless of dIII.

Cylinder.—When the telescopic hoist is actuated from its collapsed position the larger diameter sleeve or cylinder moves first with a force equal to the area of dIV multiplied by the oil pressure. When it has moved to its stop position "X" the second or intermediate cylinder moves out with an effort equal to dv times the oil pressure. Finally the next moves on in the same manner. It can be seen that if this hoist was of similar construction to Fig. 2a it would require a great deal more oil for the same stroke. Furthermore, if (as in a dump truck) the load decreased, the oil pressure would get quite low as the body is raised and the time of hoisting would also be longer. Although the primary thought in the design of a telescopic cylinder is the adaptation of a long stroke hoist in a limited space, it has the added advantage of giving greater lifting speed with the same pump output.

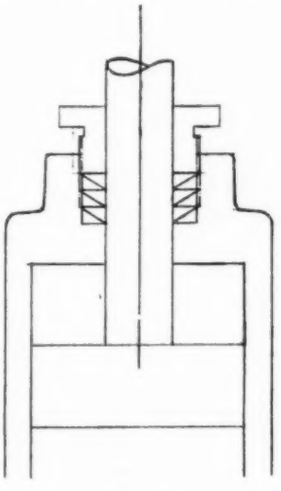


Fig. 3a

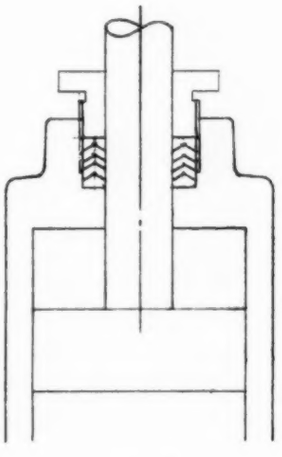


Fig. 3b

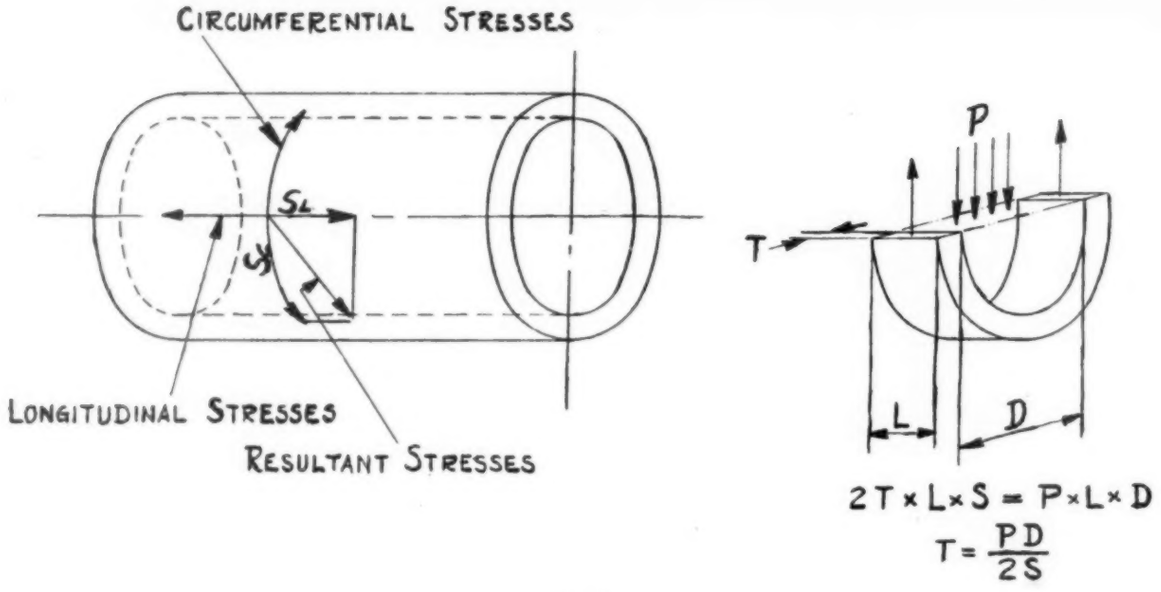


Fig. 4

by operating at higher pressures throughout the stroke. This type of hoist is more costly in construction than the conventional hoist and chances for leaks are more possible. Modern seals of the chevron type or equal have proven to be very successful and hold high pressures with little or no loss of oil.

Double acting hoists are similar in construction to the single acting as shown in Fig. 2a. The only difference is in the piston construction, that it is of the double cup leather type, and that the piston rod packing must hold against oil pressure and not just wipe the piston rod clean and prevent dirt from entering the hoist as in the case of the single acting hoist shown in Fig. 2a.

As stated before, the cylinders of the hoist are both made of grey iron or steel tube construction. The former has the advantage of incorporating trunnion cores for oil passages and flanges for pump mounting in the casting. It has the disadvantage of being heavier in weight. Some alloy cast irons do approach the tensile strength of mild steel. An analysis of approximately 3 per cent carbon, 1.50 per cent silicon, 1.00-1.25 per cent nickel, 0.50 per cent molybdenum and 0.30 per cent chromium has a tensile strength of about 52,000-55,000 lb. per sq. in. It has a Brinnell of 200 and is still machinable. The strength of the material does not always regulate the wall thickness and generally foundry practice and the design are the determining factors. In general, good nickel grey iron castings apply themselves very nicely as they have good machineabliity, a close grain structure and a tensile strength around 35,000 to 40,000 lb. per sq. in. They also hold a fairly constant hardness through the entire casting. Where plain grey iron castings of 3.15 per cent total carbon, 1.15 per cent silicon would have an approximate Brinnell hardness of 200 in the one-inch section, they would have 350 Brinnell in the one-quarter inch sections. The same iron but with an addition of 3 per cent nickel would have 240 Brinnell in the one-inch section and 255 in the one-quarter inch. (One varied 150 points to the other 15.) The plain grey iron would have approximately 40,000 lb. per sq. in. tensile strength and the nickel iron 47,000 lb. per sq. in. This is an important feature, not alone in the machining, but in service also. In cast iron cylinders, both piston ring type of pistons, and cup leather sealed pistons are used.

Hoists constructed of steel tubes have the primary feature of weight reduction, but must be designed to avoid warping caused by welding. Welding within the range of operation of the piston should be avoided if possible. The shell or cylinder thickness is determined by the calculated stresses and is not affected by foundry practice, but in its design care should be taken that impact or overloads other than developed by the pump be taken into consideration and that the walls are strong enough to withstand these superimposed pressures. The piston in such hoists is generally of the cup leather construction which will hold its seal even with small irregularities which may be found in the commercial run of this type of tubing. However, cast iron type pistons fitted with piston rings are also used in this service but the bore must be checked for roundness and diameter variations if not bored or honed.

A hoist cylinder can in general be classified as thin walled in which we can assume a uniform stress distribution throughout the material in a given plane. The thickness required for the circumferential tension (see Fig. 4) can be determined by the formula

$$t = \frac{P.D.}{2S} \text{ or } S_c = \frac{PD}{2t}$$

Where — P = The hydraulic pressure in pounds per sq. in.
t = Thickness in inches
D = The internal diameter
S_c = Allowable stress in pounds per sq. in.
A = Area of piston in square inches

Should the ratio of wall thickness to inside diameter approach 1 to 8 the cylinder can be classified as thick walled.

The stresses are no longer considered uniform and become greater on the inside of the walls. When $t/d = 1/8$ the stress increases 14 per cent and when $t/d = 1/4$ it increases 30 per cent. More accurate formulas have been developed employing higher mathematics, still for general application the above is accurate enough and within the range of the factors of safety allowed.

If the hoist is suspended on trunnions as shown in Figure 2a, we have also a longitudinal tension due to

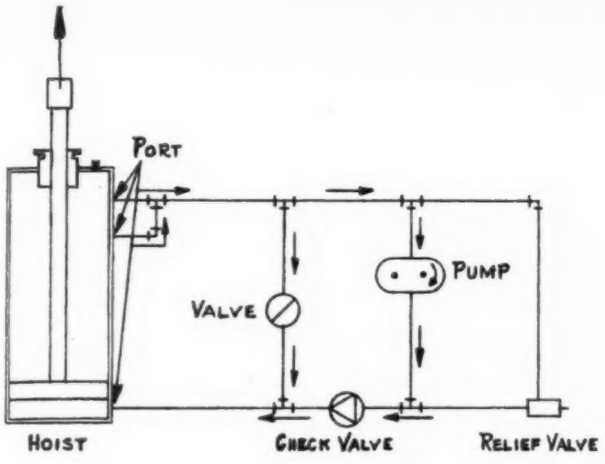


Fig. 5a

internal pressure besides that of the circumferential. Here again the writer will use a simpler and less accurate method of calculation to meet the general demand and to bring out a general rule. Let us assume that the internal longitudinal force of A x P is counteracted and balanced by the equal reaction of S x πDt

$$\text{Therefore } AP = \frac{\pi DP}{4} = S_1 \pi Dt$$

$$\text{or} \qquad S_1 = \frac{PD}{4t}$$

$$t = \frac{PD}{4S}$$

By comparing the above two formulae for circumferential and longitudinal wall thickness it can be seen that as a rule the longitudinal stresses require but approximately one-half the wall thickness of that of the circumferential.

Where the cylinder is subjected to biaxial stress which is a combination of both circumferential and longitudinal stresses the resultant of the two must be calculated. This stress is 11 per cent greater than the circumferential alone and the resultant stress would be

$$S_r = \frac{1.11PD}{2t} = 0.550PD$$

The maximum shear stress S_s with biaxial loading equals

$$S_s = \frac{S_c - S_1}{2} \sin 2\theta$$

$$S_c = 2S_1$$

$$S_s = \frac{S_c - \frac{1}{2}S_c}{2} \sin 2\theta$$

$$= \frac{S_c}{2} \sin 2\theta$$

$$\text{Tan } \theta = \tfrac{1}{2}$$

$$\theta = 26° - 34$$

$$2\theta = 53° - 8$$

$$\text{Sin } 2\theta = 0.8$$

$$\text{or } S_s = 0.2S_c$$

Valves.—Valves used in hydraulic systems are varied. A popular type is the rotary plug valve either straight or tapered. The latter lends itself to lower machinery costs and can be re-fitted by lapping. It is not a balanced valve even though the ends be ported to the suction or low pressure side of the system. End thrust can be offset by a spring pressure or thrust bearing to prevent binding. An included angle of approximately 13°-plus has been known to work satisfactorily without having the plug lock or wedge itself tight when rotated. The cylinder or straight type of valve can be perfectly balanced endwise by drilling a hole to connect both ends. Where high pressures are used the radial load is taken by roller or ball bearings on the shaft for easy operation.

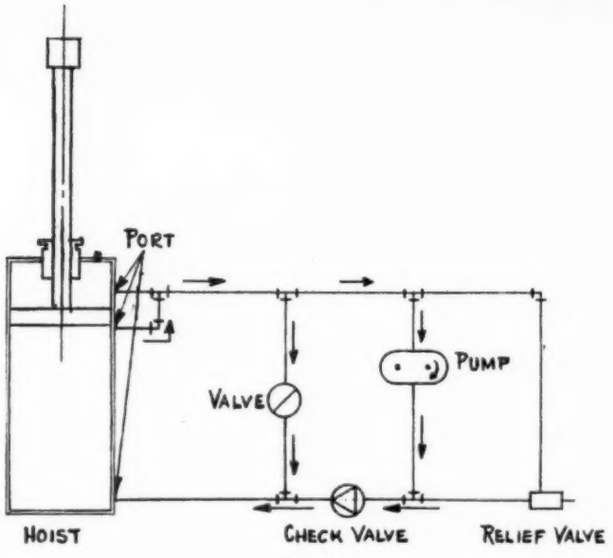


Fig. 5b

Slide valves are sometimes employed, some being magnetically operated. Poppet valves are also used but are less common.

Where the pump and valve can be mounted directly on the hoist it has been found best to do so. This not only eliminates all hose and joint leakage problems but reduces the friction in the system and the wear and tear on the equipment. It is not always possible to connect the pump, valve and hoist in one unit. In such cases some kind of a flexible connection must be used. There are on the market today high pressure rubber hoses up to 1¼ inch inside diameter capable of withstanding 4,000 lb. per sq. in. pressure which is amply high and has been found to meet the requirements, as normally pressures over 800 lb. are not used for continuous operation. These hoses are also built to stand the abuse allotted to road machinery. They are constructed of oil resistant rubber, reinforced sufficiently to withstand the load but still not too stiff for the required flexibility. The oil velocities through the piping should not be over 3 feet per second in a long line and not over 5 feet per second in a short run.

Packing.—There are several types of packings used which can be grouped into two classifications, namely rope packing and formed packing. The rope packing is used for lower pressures and small diameters such as around piston rods. The material varies with the manufacture of the packing but generally consists of a graphited flax or similar material. Some are even of the lead foil type. The formed packings are of rubber, flax, leather or similar composition, graphited, and cut or formed to meet the required dimensions. Larger diameter or higher pressure packings are of the self sealing type and are constructed as shown in Figures 3a and 3b.

These packings are relatively short, require very little takeup and give long service. It is surprising how the

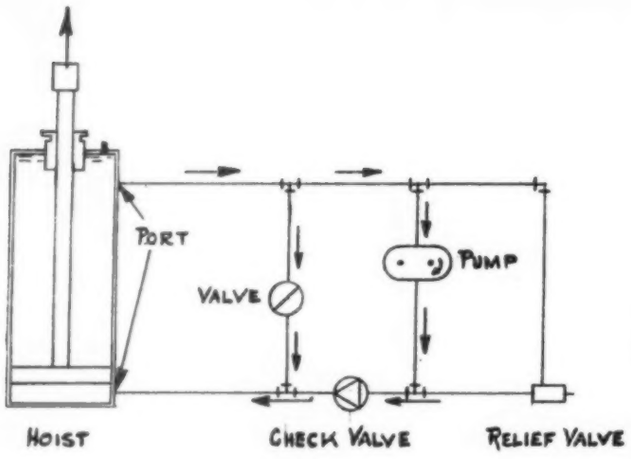


Fig. 6a

chevron type of packing will seal an 8 to 9 inch diameter without a noticeable loss of oil.

Circulation Systems.— In dump body work two types of single acting hydraulic systems are used, namely circulating and non-circulating.* In the circulating type the end of the stroke is determined by a port which permits the oil to return to the suction side of the system where the piston uncovers it as shown in Figure 5a.

The piston, Figure 5a, starts up on its stroke when the pump drawing the oil from the space in the cylinder above the piston forces it through the check valve into the lower chamber of the hoist. This continues until the lower edge of piston uncovers the port "P." The pump continues to maintain its supply of oil, but circulates its total capacity through port "P" still holding the load and piston in position. The pump should then be stopped to prevent over-heating of the oil. When this is done the load is held from coming down by check valve "C." The body is lowered by opening valve "V" which returns the oil to the space above the piston.

In the non-circulating system the stroke is determined by a port which cuts off the oil supply to the pump as shown in Figures 6a and 6b:

Here again the pump draws the oil from above the piston, and forces it below the piston to raise the load. When the upper edge of the piston comes to the end of the stroke it closes off suction port "P" and shuts off the oil supply to the pump and terminates the stroke of the

*Patent on this system is held by the Hell Co.

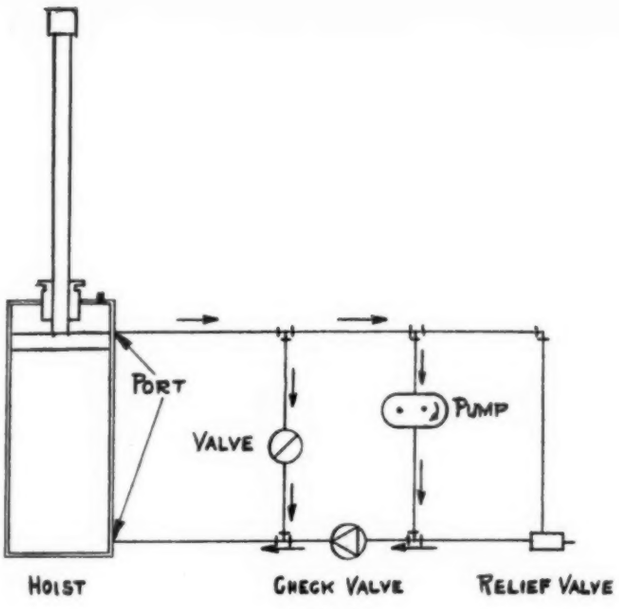


Fig 6b

piston. The pump in this case does not pump any oil and practically works at no load. The check valve here again holds the load where the pump is stopped. This system eliminates the use of an oil storage tank by utilizing the space above the piston for such purposes. The relief valve protects the pump and hoist from overloads.

Figures 7a and 7b show the general scheme for a double acting hydraulic system.

In this system the pump rotates in but one direction and the oil flow is reversed by means of a multi-ported control valve. This valve is made in various types and designs, using disc valves with sliding faces, rotary or sliding valves. They generally have three positions, namely forward, backward and neutral. In some cases the neutral position permits the piston free motion without resistance, in others it is arranged to hydraulically lock the piston in position. The check valve holds the load in case of pump or relief valve failure; also, to hold the load when the pump is stopped without depending on the control valve setting. The relief valve in this system is more important than in the single action system described above and must be used in all cases to prevent over-loading.

Relief Valve.—In some cases a pop-valve is used instead of a relief valve. This differs from the relief valve in such a way that when the maximum pressure setting is reached it opens and maintains a low pressure.

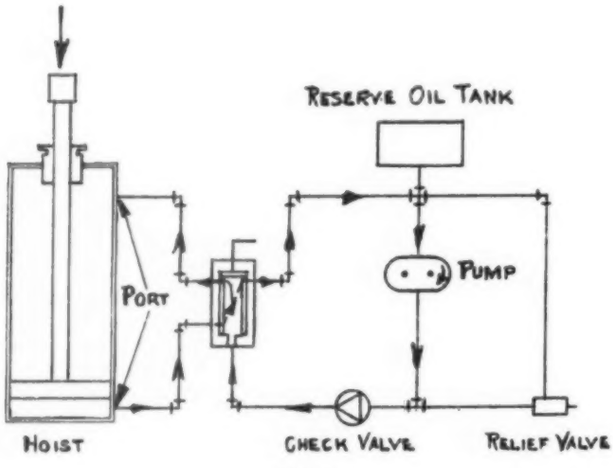


Fig. 7a

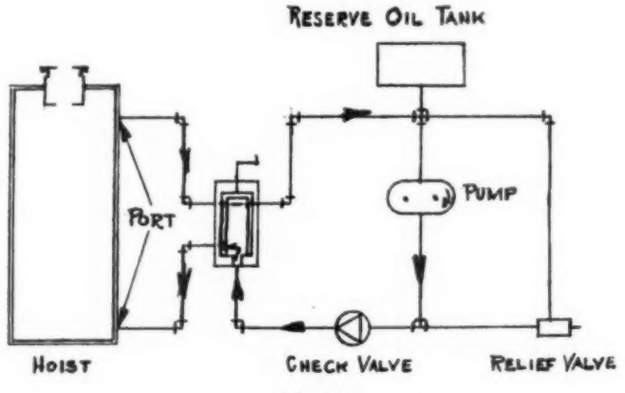


Fig. 7b

thus taking practically the entire load off the pump. It is reset by stopping the pump long enough for the oil pressure to drop below its lower setting. This requires but a few seconds after the pump stops. When the pop valve releases the check valve must hold the entire load whereas the relief valve when it reaches its maximum setting or by-pass pressure it does not lower the pressure but maintains the maximum setting by by-passing the oil. The latter is the most generally used.

When a hydraulic system is started for the first time, quantities of air are trapped within the system which result in jerky operation of the hoist. To remove this air from the system vents or pipe plugs should be provided at the hoists and in high points in the system. These plugs should be loosened and the hoists worked up and down until the oil flows freely out of the threads of the plugs and the air has ceased to escape. The plugs should then be tightened. Under normal operation the air would, in time, escape through the relief valve but bleeding the system at the start is recommended. Other factors which should be noted in the operation and maintenance of hydraulic equipment are:

1. Do not run the pump without oil.
2. Do not use too heavy a grade of oil—use the manufacturers' recommendations.
3. Do not let dirt, grit or water get into the oil.
4. Do not use crank case drainings.
5. Do not think that any oil is good enough, but use an oil recommended for the equipment. The best grade is the cheapest in the long run.
6. Do not operate at unnecessarily high pressures. Set the relief valve for sufficient pressure to operate the equipment but no higher.

The writer has attempted to give a general description of some of the more important points in hydraulic systems and has tried to avoid highly technical formulas but still wanted to give the reader a guide in determining the requirements and calculations involved in the system. He has felt that men familiar with the more involved methods of calculating the stresses in cylinders, friction in pipes and valves would not need this information other than comparing or adding it to their present knowledge.

Much more can be written about hydraulic systems and much more will be done with them as modern machinery and materials are developed. There is no doubt that they will advance to the front and that modern engineering will attempt to apply hydraulic systems wherever possible because they are simple, flexible and adaptable.

▼

Notes About a Smooth Road Surface

A. Puddle Jumper, on a trip to Florida after the New Orleans A. R. B. A. convention, drove over a long stretch of excellent road surface in Alabama about 11:00 o'clock one night. The section of highway was southeast out of Dotham to the Georgia State line.

Project E.F.A.P. 170, Houston County, is 10 miles long, was awarded to Barber Construction Company on February 4, 1933, and was finished August 29, 1933. The contract price for grading drainage and surfacing was $119,232.92.

The surfacing consisted of a two course sand asphalt hot mix, a three-inch base and a two-inch top or wearing course bound together by a tack coat of asphalt, and cost the State eighty-seven cents (0.87c) per square yard in place.

The mixture of the sand asphalt was local sand and 40 to 50 penetration asphalt in a mixer of the pug type at a temperature of 325 degrees to 400 degrees Fahrenheit and the average mix was as follows:

Passing	Retained	Top Percentage	Base Percentage
¼	No. 10	.76	.71
No. 10	No. 40	21.25	23.47
No. 40	No. 80	33.03	36.39
No. 80	No. 200	24.25	25.03
No. 200		10.94	6.79
Bitumen		9.77	7.61
		100.00	100.00

The stability was around 20 lb. per square inch when tested with a Chicago paving machine.

Project NRM 170A, NRH 170A and NRH 170A Ext., Houston County, is 12.331 miles long, and was awarded to Wm. P. McDonald Construction Company on October 30, 1933, and was finished July 2, 1934. The contract price for grading, drainage and surfacing was $184,952.51.

The surfacing consisted of a two course hot mix sand-asphalt, a three-inch base and two-inch top or wearing course, bound together by an asphalt tack coat and cost the State one dollar and two cents ($1.02) per square yard in place.

This mixture of sand-asphalt was made from local sand and 40 to 50 penetration asphalt in a mixer of the pug type at a temperature ranging from 325 degrees to 400 degrees Fahrenheit and the average mix was as follows:

Passing	Retained	Top Percentage	Base Percentage
¼	No. 10	0.66	0.42
No. 10	No. 40	31.00	36.00
No. 40	No. 80	32.00	35.00
No. 80	No. 200	19.00	17.00
No. 200		8.04	4.08
Bitumen		9.50	7.50
		100.00	100.00

The stability was around 16 lb. per square inch when tested with a Chicago paving machine.

Remarks.—Quite a difference will be noticed in the mixtures used and the shear per square inch in the paving for the two projects. The mix was opened up on the last project in order to eliminate some cracking that occurred on the first one.

The State has further opened up the mixes on sand asphalt with good results.

▼

TRAFFIC OVER AUSTRIAN GROSSGLOCKNER HIGHWAY.—In 1936, automobiles from other countries comprised nearly half of the total number which traveled over the Grossglockner alpine highway in Austria. In 1935 foreign cars only accounted for a third of the total. The total number of persons increased some 12 per cent over the previous year, but it must be recalled that the road was not thrown open to traffic until Aug 3, 1935. Very little travel can be undertaken over this mountainous road before June 15 or after Oct. 1, in spite of modern snow removal equipment and a force of some 200 workers on full time duty during the winter season.

The following table shows motor vehicle circulation over the Grossglockner road since its completion in August, 1935:

	1935	1936
Number of people	30,571	146,003
Automobiles	19,309	24,113
Motorcycles	5,482	5,280
Motor-buses	4,174	5,105
Bicycles	4,280	7,693

COMPARATIVE INFORMATION

THIS is a continuation of the tables published in the January, February and March issues of ROADS AND STREETS. As stated in the January issue, they are not to be considered as a complete specification material. We ask that the tables be used more as guides in discussions than for selecting equipment. Manufacturers

PULL GRADERS

Manufacturer	Size	Weight (Approx.) Shipping Hand Controls	Weight (Approx.) Shipping Power Controls	Wheel Base	Controls	Blade Assembly Length	Blade Assembly Lift Above Ground	Blade Assembly Angle Bank Cutting
J. D. Adams Company	No. 125	....×....	10280 Lb.	17'-10"	Power	12'-0"	17"	90°
	No. 124	9800 Lb.	....×....	17'-10"	Hand	12'-0"	17"	90°
	No. 105	....×....	7900 Lb.	15'-5"	Power	10'-0"	16"	90°
	No. 104	7500 Lb.	....×....	15'-5"	Hand	10'-0"	16"	90°
	No. 84	5800 Lb.	....×....	13'-10"	Hand	8'-0"	15"	90°
	No. 72	3500 Lb.	....×....	11'-3"	Hand	7'-0"	11½"	66°
	No. 11	2080 Lb.	....×....	9'-5"	Hand	6'-6"	7½"	..×..
Allis-Chalmers Mfg. Co.	No. 14	....×....	12410 Lb.	18'-0"	Power	12'-0"	16"	80°
	No. 12	....×....	10800 Lb.	17'-0"	Power	12'-0"	14¾"	70°
	No. 10	7100 Lb.	....×....	15'-5"	Hand	10'-0"	15"	70°
	No. 8	5540 Lb.	....×....	13'-6"	Hand	8'-0"	13"	60°
Austin-Western Road Mchy. Co.	No. 12	....×....	12200 Lb.	18'-9"	Power	12'-0"	14"	73°
	No. 11	9700 Lb.	10100 Lb.	17'-6"	Power & Hand	12'-0"	17"	73°
	No. 10	7400 Lb.	8200 Lb.	15'-7"	Power & Hand	10'-0"	17"	Over 70°
	No. 8	5800 Lb.	....×....	13'-6"	Hand	8'-0"	13"	Over 70°
	Standard	3500 Lb.	....×....	11'-11"	Hand	7'-0"	12¾"	..×..
	No. 1 Patrol	1700 Lb.	....×....	9'-0"	Hand (d)	8'-0"	...	..×..
	No. 12 Patrol	1330 Lb.	....×....	8'-7"	Hand (d)	8'-0"	...	..×..
Caterpillar Tractor Co.	No. 77	....×....	12170 Lb.	18'-4"	Power	12'-0"	15½"	65°
	No. 66	10440 Lb.	10900 Lb.	17'-9"	Power or Hand	12'-0"	18"	90°
	No. 44	7700 Lb.	8170 Lb.	15'-0"	Power or Hand	10'-0"	17"	90°
	No. 33	5810 Lb.	....×....	13'-6"	Hand	8'-0"	17"	65°
	No. 22	3575 Lb.	....×....	11'-6"	Hand	8'-0"	13"	70°
	No. 4 Hi-Way Patrol	1650 Lb.	....×....	9'-7"	Hand	8'-0"	11"	..×..
	Trailer Patrol	5920 Lb. (a)	5760 Lb. (a)	13'-6"	Power or Hand	12'-0"	12"	..×..
Foote Bros. Gear & Machine Corp.	No. 1 Shoulder Patrol	2000 Lb.	.....	10'	Hand	8'-0"	12"	..×..
	No. 2 Shoulder Patrol	3000 Lb.	.....	12'-1½"	Hand	10'-0"	14"	..×..
	No. 20	1250 Lb.	.....	9'-2"	Hand	6'-0"	11"	..×..
	No. 30	1850 Lb.	.....	10'	Hand	8'-0"	11"	..×..
	No. 40	3400 Lb.	.....	12'-1½"	Hand	8'-0"	11"	..×..
	No. 35-8	4500 Lb.	.....	12'-10"	Hand	8'-0"	14"	..×..
	No. 1 Whippet	3000 Lb.	.....	12'-1½"	Hand	10'-0"	14"	..×..
	No. 2 Whippet	5320 Lb.	.....	14'	Hand	12'	9"	..×..
	Greyhound	5500 Lb.	.....	12'-10"	Hand	14'	12"	..×..
Gilbert Mfg. Co.	No. 14 Heavy Duty	.....	14000 Lb.	20'-2"	Power	14'-0"	16½"	30°
	No. 12 Heavy Duty	.....	11600 Lb.	19'-2"	Power	12'-0"	16"	90°
	No. 12 Standard	.....	9600 Lb.	19'-2"	Power	12'-0"	16"	90°
	No. 10 Heavy Duty	.....	8600 Lb.	16'-0"	Power	10'-0"	16"	90°
	No. 10 Standard	.....	7100 Lb.	16'-0"	Power	10'-0"	16"	90°
	No. 8 Heavy Duty	.....	5890 Lb.	13'-0"	Hand	8'-0"	14"	70°
	No. 8 Standard	.....	4500 Lb.	12'-9"	Hand	8'-0"	13"	70°
	No. 8 H.S. Truck	.....	5200 Lb.	12'-9"	Hand	8'-0"	13"	...
	No. 8 One-ton Truck	.....	4450 Lb.	12'-9"	Hand	8'-0"	13"	...
Northfield Iron Co.	Husky No. 22	1460 Lb.	.....	9'-7"	Hand	8'-0"	14"	32°
	No. 2 Northfield	1293 Lb.	.....	8'-0"	Hand	8'-0"	12"	30°
Rome Grader and Machinery Corp.	LW 14	13000 Lb.	....×....	18'-6" (c)	Hand	14'-0"	14"	.....
	LW 12	12300 Lb.	....×....	18'-6" (c)	Hand	12'-0"	14"	.....
	LW 12A	10300 Lb.	....×....	16'-2½" (c)	Hand	12'-0"	14"	.....
	LW 10A	7250 Lb.	....×....	15'-6" (c)	Hand	10'-0"	15"	.....
	HLW 8	6755 Lb.	....×....	15'-6"	Hand	8'-0"	15"	.....
	LW 8	5625 Lb.	....×....	13'-6" (c)	Hand	8'-0"	15½"	.....
	HLW 7	4510 Lb.	....×....	13'-4"	Hand	7'-0"	16"	.....
	LW 7	3875 Lb.	....×....	11'-10" (c)	Hand	7'-0"	15"	.....
	No. 8 Quick Hitch	4300 Lb.	....×....	13'-6"	Hand	8'-0"	15"	.....
	No. 7 Quick Hitch	3250 Lb.	....×....	12'-0"	Hand	7'-0"	16"	.....

NOTE: (.....) signifies information not available when this form printed.
(..×..) signifies information not available because of grader design.

(a) With auxiliary rear controls.
(b) Power wheel leaning arrangement available for hand controlled machines.

ON ROAD-BUILDING EQUIPMENT

of equipment should be contacted in cases where purchase of new equipment is involved. New models and improvements to older units occur constantly so that what is listed here may not be the latest at the time purchase is contemplated.

PULL GRADERS

Lifting Mechanism				Front Wheels			Rear Wheels		
Design	Lifting Link Construction	Lifting Link Connections	Wear Take Up	Type	Diameter	Bearings	Type	Diameter	Bearings
Worm and gear	Left link adj. for 2 lengths	Ball and Socket	Split Bearings Shims	Leaning	36"	Tapered Roller	Leaning	44"	Tapered Roller
Worm and gear	Left link adj. for 2 lengths	Ball and Socket	Split Bearings Shims	Leaning	36"	Tapered Roller	Leaning	44"	Tapered Roller
Worm and gear	Left link adj. for 2 lengths	Ball and Socket	Split Bearings Shims	Leaning	34"	Tapered Roller	Leaning	40"	Tapered Roller
Worm and gear	Left link adj. for 2 lengths	Ball and Socket	Split Bearings Shims	Leaning	34"	Tapered Roller	Leaning	40"	Tapered Roller
Worm and gear	Left link adj. for 2 lengths	Ball and Socket	Split Bearings Shims	Leaning	32"	Tapered Roller	Leaning	36"	Tapered Roller
Worm and gear	Left link adj. for 2 lengths	Ball and Socket	Split Bearings Shims	Leaning	30"	Hyatt	Leaning	36"	Hyatt
Worm and gear	Solid Bar	Ball and Socket	Split Bearings Shims	Leaning	24"	Hyatt	Leaning	30"	Hyatt
Worm and gear	Solid Bar	Ball and Socket	Split Bearings Shims	Leaning	38"	Tapered Roller	Leaning	48"	Tapered Roller
Worm and gear	Solid Bar	Ball and Socket	Split Bearings Shims	Leaning	34"	Tapered Roller	Leaning	44"	Tapered Roller
Worm and gear	Solid Bar	Ball and Socket	Split Bearings Shims	Leaning	32"	Tapered Roller	Leaning	42"	Tapered Roller
Worm and gear	Solid Bar	Ball and Socket	Split Bearings Shims	Leaning	29"	Tapered Roller	Leaning	39"	Tapered Roller
Hydraulic	Telescoping	Ball and Socket	Split Bearings Shims	Leaning	34"	Tapered Roller	Leaning	44"	Tapered Roller
W'm & g'r—H.C. Hydraulic—P.C.	Telescoping	Ball and Socket	Split Bearings Shims	Leaning	34"	Tapered Roller	Leaning	44"	Tapered Roller
W'm & g'r—H.C. Hydraulic—P.C.	Telescoping	Ball and Socket	Split Bearings Shims	Leaning	32"	Tapered Roller	Leaning	42"	Tapered Roller
Worm and gear	Telescoping	Ball and Socket	Split Bearings Shims	Leaning	30"	Tapered Roller	Leaning	36"	Tapered Roller
Worm and gear	One Piece	Ball and Socket	Split Bearings Shims	Leaning	30"	Tapered Roller	Leaning	36"	Tapered Roller
Open worm and gear	One Piece	Ball and Socket	Split Bearings Shims	Straight	24"	Tapered Roller	Straight	40"	Tapered Roller
Open worm and gear	One Piece	Ball and Socket	Split Bearings Shims	Straight	24"	Plain	Straight	36"	Plain
Worm and gear	Telescoping	Ball and Socket	Split Bearings Shims	Leaning	36"	Tapered Roller	Leaning	46"	Tapered Roller
Worm and gear	Telescoping	Ball and Socket	Split Bearings Shims	Leaning	34"	Tapered Roller	Leaning	44"	Tapered Roller
Worm and gear	Telescoping	Ball and Socket	Split Bearings Shims	Leaning	32"	Tapered Roller	Leaning	40"	Tapered Roller
Worm and gear	Telescoping	Ball and Socket	Split Bearings Shims	Leaning	30"	Tapered Roller	Leaning	40"	Tapered Roller
Worm and gear	Telescoping Left Solid Right	Ball and Socket	Split Bearings Shims	Leaning	28"	Tapered Roller	Leaning	36"	Tapered Roller
Worm and gear	Solid Round	Ball and Socket	Split Bearings Shims	Straight	22"	Tapered Roller	Straight	28"	Tapered Roller
Screw & Nut	Screw	Ball and Socket(e)	Split Bearings, bronze nuts & yokes	Straight	29"	Tapered Roller	Straight	40"	Tapered Roller
Worm and gear	One Piece	Ball and Socket	Split	Straight	None	Timken	Straight	...	Timken
Worm and gear	One Piece	Ball and Socket	Split	Straight	None	Timken	Straight	...	Timken
Worm and gear	One Piece	Ball and Socket	Split	Straight	24"	Timken	Straight	...	Timken
Worm and gear	One Piece	Ball and Socket	Split	Straight	26"	Timken	Straight	...	Timken
Screw	One Piece	Ball and Socket	Split	Straight	27"	Timken	Straight	...	Timken
Worm and gear	One Piece	Ball and Socket	Split	Straight	29"	Timken	Straight	...	Timken
Worm and gear	One Piece	Ball and Socket	Split	Straight	26"	Timken	Straight	...	Timken
Worm and gear	One Piece	Ball and Socket	Split	Straight	29"	Timken	Straight	...	Timken
Worm and gear	One Piece	Ball and Socket	Split	Straight	29"	Timken	Straight	...	Timken
Worm and gear	Left link adj. for 2 lengths	Ball and Socket	Split Bearings Shims	Leaning	36"	Timken	Leaning	46"	Timken
Worm and gear	Left link adj. for 2 lengths	Ball and Socket	Split Bearings Shims	Leaning	36"	Timken	Leaning	46"	Timken
Worm and gear	Left link adj. for 2 lengths	Ball and Socket	Split Bearings Shims	Leaning	36"	Timken	Leaning	46"	Timken
Worm and gear	Left link adj. for 2 lengths	Ball and Socket	Split Bearings Shims	Leaning	36"	Timken	Leaning	46"	Timken
Worm and gear	Left link adj. for 2 lengths	Ball and Socket	Split Bearings Shims	Leaning	36"	Timken	Leaning	42"	Timken
Worm and gear	Left link adj. for 2 lengths	Ball and Socket	Split Bearings Shims	Leaning	30"	Timken	Leaning	40"	Timken
Worm and gear	Left link adj. for 2 lengths	Ball and Socket	Split Bearings Shims	Leaning	30"	Timken	Leaning	40"	Timken
Worm and gear	One Piece	Ball and Socket	Split Bearings Shims	Straight	32"	Timken	Leaning	40"	Timken
Worm and gear	One Piece	Ball and Socket	Split Bearings Shims	Straight	30"	Timken	Leaning	40"	Timken
Worm and gear	One Piece	Ball and Socket	Split Bearings Shims	Straight	24"	Rollite	Straight	36"	Rollite
Worm and gear	One Piece	Sleeve Pin	New Sleeves	Straight	24"	Rollite	Straight	36"	Rollite
Worm and gear	One Piece	Ball and Socket	Split Bearings Shims	Leaning(f)	36"	Timken	Leaning(f)	48"	Timken
Worm and gear	One Piece	Ball and Socket	Split Bearings Shims	Leaning(f)	36"	Timken	Leaning(f)	48"	Timken
Worm and gear	One Piece	Ball and Socket	Split Bearings Shims	Leaning(f)	36"	Timken	Leaning(f)	48"	Timken
Worm and gear	One Piece	Ball and Socket	Split Bearings Shims	Leaning(f)	30"	Timken	Leaning(f)	40"	Timken
Worm and gear	One Piece	Ball and Socket	Split Bearings Shims	Leaning(f)	30"	Timken	Leaning(f)	40"	Timken
Worm and gear	One Piece	Ball and Socket	Split Bearings Shims	Leaning(f)	30"	Timken	Leaning(f)	40"	Timken
Worm and gear	One Piece	Ball and Socket	Split Bearings Shims	Leaning(f)	30"	Timken	Leaning(f)	40"	Timken
Worm and gear	One Piece	Ball and Socket	Split Bearings Shims	Leaning(f)	26"	Timken	Leaning(f)	34"	Timken
Worm and gear	One Piece	Ball and Socket	Split Bearings Shims	Straight	30"	Timken	Straight	40"	Timken
Worm and gear	One Piece	Ball and Socket	Split Bearings Shims	Straight	26"	Timken	Straight	34"	Timken

(c) Also available as "Scarifier Model" with longer wheel-base.
(d) Circle reverse by hand from ground.
(e) Reinforced.
(f) Also available with straight wheels.

Federal Funds Available for the
Federal Funds Available for the
ary 31, 1937, $227,704,514

ROAD BUILDERS

APRIL, 1937 **AMERICAN ROAD BUILDERS'**

Down the Road

By C. M. UPHAM

Engineer-Director,
American Road Builders' Association

Down With Diversion!

Sounds like the battle cry of a far-flung revolutionary movement, doesn't it? Believe you me, that is exactly what it is, entirely orderly and well-grounded, minus long beards, red-flag waving and radical action. Legislators, farm and trade organizations, motorists' associations and intensely interested individuals throughout the nation have "revolted" against the misappropriation by any state of highway-tax funds for any use other than the building and upkeep of good roads. Figuratively caught with the current "sit-down" fever, the government "sat down" on Maryland for continuing to flaunt the penalty provisions of Section 12 of the Hayden-Cartwright Road Act of 1934. The Annapolis legislature proposed diversion legislation and immediately found itself in the "middle." Notified by the United States Bureau of Public Roads that $341,666 was to be sliced from Maryland's federal-aid apportionment for highways, sentiment mounted to the boiling stage and much-needed pressure was turned loose. Indications now point to the restoration to highway purposes of the money proposed by Maryland's legislature for diversion to general use. If this proves true, Diversion has lost its "Bastile" and the "revolutionists" have won a conspicuous victory. It is to be hoped that the cry of "DOWN WITH DIVERSION" will echo and re-echo from the Pacific to the Atlantic, from the Great Lakes to the Gulf of Mexico, until, with the full-meaning sound ringing in their respective ears, each one of the 48 state legislatures, in turn, "sit down" on diversion.

Charles M. Upham

Forward-Mindedness

It is always gratifying to note the forward-mindedness of our friendly Mexican neighbors. Mexico in recent years has taken great strides in road building, admirably exemplified by the completion of the Laredo-Mexico City Highway, a most important link in the gigantic undertaking which will be the Pan-American Highway. Now word comes that efforts are being made by the Mexican government to project and complete an additional highway from the Texas border to Mexico City. Approximately 1,600 miles will be traversed by this new highway from Nogales, through Guadalajara, to the capital city. According to the Mexican Automobile Association the road will be ready for through traffic at the end of 1938 after an expenditure of about $16,650,000. If and when completed, this highway will shorten the route from the western part of the United States to Mexico City some four or five hundred miles. The motivating personalities in the government in the Mexican Automobile Association and in the co-operating Mexican states, through which the road will pass, are to be congratulated on their enterprise—their forward-mindedness.

▼

Salutation from Venezuela

According to a communication from the American consulate at Caracas, Venezuela, copies of Convention Proceedings of the American Road Builders' Association have been presented to and appreciatively received by Engineer Tomas Pecanins, Venezuelan minister of public works and the progressive individuality in charge of road projects in that country. This publication is more and more being accepted as a textbook on road building by "road-minded" persons. Venezuela, like Mexico and other Pan-American countries, is doing and plans to continue to do "big things" in the way of an adequate highway system.

Associated Pennsylvania Constructors Affiliate with American Road Builders

Nearly One Hundred Compose Groups' Active Membership.

Most recent group of road builders to join the ranks of the American Road Builders' Association, Washington, D. C., according to an announcement from the office of Charles M. Upham, engineer-director of the organization, is the Associated Pennsylvania Constructors, headquartered at Harrisburg, Pa.

The affiliation of this group, composed of nearly one hundred members who are recognized as leaders in their field of endeavor, was consummated March 11, 1937.

The Associated Pennsylvania Constructors, as an organization, has been active for more than 15 years. The official publication of the group, the "Highway Builder," has come to be accepted as an authoritative mouthpiece in the construction world.

Remarking on the affiliation, Mr. Upham said, "I am particularly pleased to be able to announce the affiliation of the Associated Pennsylvania Constructors. The A.R.B.A. is fortunate in having the fine representation afforded by this splendid body of men. It is a pleasure to have them associated with our organization. We feel that another wide-awake unit has been added to our group of state organizations that are pushing the highway program as represented and sponsored by the American Road Builders' Association."

Officers of the Associated Pennsylvania Constructors are James J. Skelly, Media, president; H. D. Maxwell, Easton, vice-president; A. H. Coon, Luzerne, chairman of the executive committee; A. E. O'Brien, Harrisburg, secretary; W. R. Wolfinger, Norristown, treasurer; W. C. M. Butler, Hazelton and Walter M. Mumma, Harrisburg, governors to serve until 1938; E. N. Woolston, Allentown, and John B. Acchione, Philadelphia, governors to serve until 1939; James T. Sweeney, Scranton; W. M. Monahan, Philadelphia; A. G. Andrew, Tyrone, and M. F. Cousler, York, members of the advisory board. The regional vice-presidents are J. P. Mack, II, Philadelphia; H. B. Sproul, Scranton; Clyde G. Thompson, Clearfield, and L. M. Hutchison, Orbisonia.

Resume'

Highway Program as of Janu-
Highway Program as of February 28, 1937, $236,252,204

ASSOCIATION–WASHINGTON, D. C. APRIL, 1937

Assistant Engineer-Director Appointed by Road Builders

The American Road Builders' Association announces the appointment of W. C. Slee, a native of Baltimore, Maryland, as assistant engineer-director of the organization.

Mr. Slee is 38. He was educated in the high school of Muncy, Pa., the Stevens Trade school in Lancaster, Pa., and the Drexel Institute in Philadelphia.

A wide experience gained from his former connections as construction engineer with several of the leading construction firms of Pennsylvania, operating in that state and in Maryland and West Virginia;

W. C. Slee

as city engineer for three years at Hagerstown, Md., and, more recently, with one of the larger road building materials companies more than qualify the new assistant engineer-director for the assignment of extending the association's socialized services to road builders throughout the various states.

Mr. Slee's line of endeavor will bring him in close association with all groups affiliated with the highway program as represented and sponsored by the A. R. B. A. He will work in collaboration with these and other interested groups toward the end of solving and eliminating local and sectional road-building problems. He will personally meet each and every city, county and state official, engineer and contractor and others connected with the construction of highways. He will see to it that all interested persons are extended the privilege of becoming active members in the American Road Builders' Association, that they may share in its progressive and far-reaching activities.

American Road Builders' Association

Anti-Diversion

The Indiana Legislature passed a Joint Resolution to amend the constitution so that highway revenues—including registration fees, licenses, gasoline taxes and all other highway taxes—be used for highway purposes and shall *not be diverted by transfer of fund, or otherwise, to any other purpose whatsoever.*

CONSTITUTIONAL AMENDMENT PROPOSALS have been introduced in the following states: Delaware, Georgia, Idaho, Iowa, Maryland, New Jersey, North Carolina, Pennsylvania, South Dakota, Utah, Washington.

The only two Legislatures which have passed the constitutional amendment proposals up to the present time are: Alabama and Indiana.

Legislature Adjournments

The following legislatures have adjourned sine die: Alabama, Arizona, Arkansas, Idaho, Indiana, Kentucky, Montana, New Mexico, North Carolina, North Dakota, Oregon, South Dakota, Utah, Washington, West Virginia, Wyoming.

45-MILE CABLEWAY DIVERTS FREIGHT FROM HIGHWAY

In order to reduce the amount of freight over the truck road and railway line between Massawa and Asmara the Italian Government has decided to make use of a third means of communication: the cableway.

This new Asmara-Massawa cableway is about 75 km. long and is divided into four principal stretches, each again subdivided into various sections.

The cableway starts at Godaif (a suburb of Asmara) directly connected with the south-bound truck roads and situated at 2,377 meters above sea level) and reaches Massawa at two different points as will be explained later.

The configuration of the land made desirable a far from straight line in planning the cableway, but this added length is compensated by advantages of a technical character indispensable for a regular functioning of the service.

Stations, supporting pylons, and intermediate tension equipment for the cables are entirely built of metal and anchorage bases are of concrete.

In all, there are 15 stations of which 8 are power-stations and 5 merely relay stations. There are 23 tension centers and about 450 pylons. The cableway can carry 30 tons per hour in both directions between Massawa and Asmara. Each transport unit consists of a steel car hanging from the cable by a 2-wheel truck and is capable of carrying 300 kilos. There will be 1,500 of these cars on the line.

The carrying cables are of high tensile strength steel of spiroidal construction, 30 mm. in diameter for both up and down lines. The tractive cables of flexible design have a diameter of 22 mm.

Movement to the tractive cable is given at the power stations by winches worked by Diesel engines. A total of about 1,200 h.p. is supplied by these engines.

The material used in the mechanical and metallic parts of the construction (ordered from the Cerretti & Tanfani Co.) is chiefly the following:

Iron sections for the stations, the pylons, and the tension equipment for a total of about 1,700 tons.

Material for the motive, breaking and relay mechanism, both along the lines and in the stations, trucks and cars for a total of about 900 tons.

Carrying cables, tractive cables and super flexible cables for working the counter-weights for a total length of about 300,000 meters and weight of about 1,000 tons.

The various parts of the equipment are built in factories in Italy and then shipped to Massawa where, on being landed, the various elements are transported to their places and erected.

Another aspect of the plan is the large amount of brick and cement construction for bases and pylons required. This is carried out by the Erithrea Public Works Office and other companies.

The cableway is already functioning from Mai Atal to Godaif (Asmara): in other words, for practically the whole of its length and in the steepest stretches. The stretch between Mai Atal and the two Massawa stations is already in advanced stage of construction and will soon be put in service.

A Section of the Asmara-Massawa Cableway

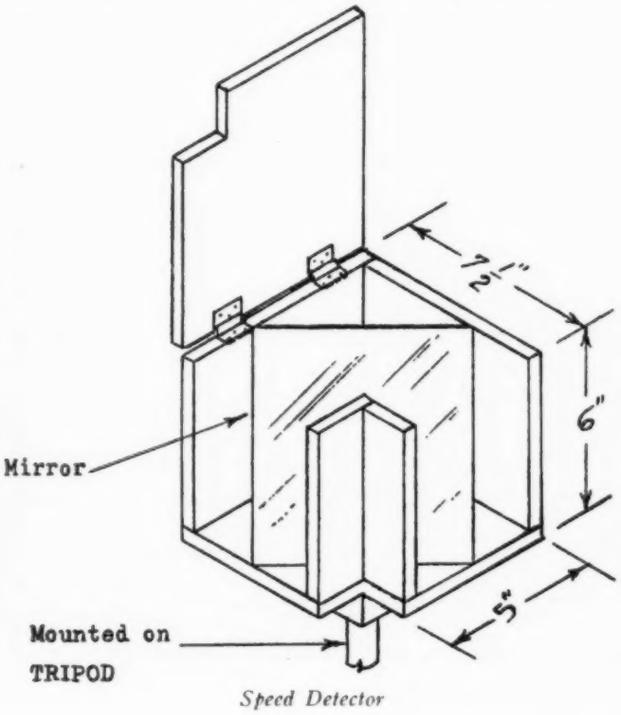
DETERMINATION OF GRADUATED SPEED REGULATIONS

By D. GRANT MICKLE

Assistant Director in Charge of Traffic Survey Michigan Highway Planning Survey, and Manager, Traffic & Transport Dept., Jensen, Bowen & Farrell, Engrs.

MICHIGAN State Highway Commissioner Murray D. Van Wagoner considers the regulation of traffic as a vital phase of highway planning. With new highways being built and old ones rebuilt to accommodate vehicles capable of traveling at high speeds, the Commissioner saw the need for a study which would give some indication of the speeds at which drivers were operating under various conditions. With this in mind a speed survey was conducted as a part of the work of the Traffic Branch of the Highway Planning Survey. It is the purpose of this article, which was presented as a paper at the Michigan Highway Conference last February, to outline the field methods used in connection with the speed observations, to present a few of the preliminary results, and to suggest ways of regulating speed according to graduated speed zones.

Method of Observation.—There are several methods of conducting speed observations. One method is to station an observer along a highway whose duty it is to record license number, direction, and the time of passing of cars as they pass his observation point. Several miles away is stationed another observer who also records license number, direction, and time, of vehicles passing his point. With the inspection of the field records, it is then possible to determine the time used by each vehicle that traversed the road section under observation. The difficulty with this method is that many cars are lost within the trap due to their entering or leaving the road between the observation points. It does have the advantage, however, of providing an average speed observation over a fairly long section of road.



Speed Detector

Another method is that used by this survey which requires only a one-man party. Speed detectors were used, as illustrated in the accompanying drawings, consisting of an L-shaped box with open ends and containing a mirror set at 45 degrees. The box is mounted upon a tripod. This detector is commonly known as the "Eno Speed Detector" and was first used in speed observations in Connecticut. Originally, the detector was placed at one end of a 176-ft. or 220-ft. trap and the observer stationed at the other end of the trap. As a car passed the observer, he started his stop-watch and as it passed the detector a flash would be noted in open end of the box facing the observer. This was the signal for stopping the watch. For speed readings of vehicles going in the opposite direction, the watch was started with the flash and stopped as the car passed the observer. However, it was found that the observer would tend to anticipate the time the vehicle would cross the imaginary line in front of him and thus would introduce a varying reaction time in either starting or stopping the stop-watch. For this reason it was decided to use two detectors, one located at each end of the trap, with one of their open ends facing the road and the other facing the observer who was stationed some distance in front of the first detector. This arrangement is illustrated in an accompanying drawing. Using this set-up the observer introduced the same reaction time in starting and stopping his stop-watch because he could not anticipate the flash of the car in the mirror of the detector.

Observations were made during the late Summer and early Fall at approximately 700 locations in the Lower Peninsula of the state, covering all types of road conditions such as: through posted speed zones, on curves, through and approaching intersections, entering and leaving cities, up grade, hill crests, down grade, on gravel, bituminous and concrete roads, and under all conditions of weather. Observations were made during all hours of the day and days of the week. Speeds were determined for passenger cars, light, medium and heavy trucks, both local and foreign. A special form was used by the observer as a field sheet in which he tallied the time required for various vehicles to pass through the 220-ft. trap. These tallies were then added and recorded on another form and the product of the number of observations times the speed in each speed group, was calculated. By adding the products of each speed group and dividing by the number of observations, the average speed at this observation point is obtained for the period the observations were made. Total traffic was also counted so that it was possible to know what percentage of the traffic

was observed for speed. As the field records were turned in to the office the data was placed on a code sheet from which cards were punched, recording all information for each group of cars traveling at a given speed at each observation point. These cards may now be sorted and tabulated to provide any combination of speed information desired.

Preliminary Results of Speed Studies.—A few preliminary tables are presented herein. By the use of punch cards it is possible to study the speed information in almost any conceivable manner, and it is hoped that many more interesting and valuable tables will result from these speed observations.

In Table I are tabulated the speed of passenger cars in various classes of posted zones. The average speed of the fastest 15 per cent is determined, the general average, pace, and the average of the slowest 15 per cent. By "pace" is meant the 10-mile range of speed including the largest number of vehicles.

TABLE I—SPEED BY CLASS OF SPEED ZONE

Class of Speed Zone	Average Fast 15% M. P. H.	Average 100% M. P. H.	Pace M. P. H.	Average Slow 15% M. P. H.	Total Observations Number Vehicles
None	49.1	45.4	39.5-50.0	29.0	21681
45 M.P.H...	58.2	43.1	39.5-50.0	29.1	1209
40 M.P.H...	50.5	39.4	34.1-44.1	35.3	153
35 M.P.H...	52.2	37.0	31.3-41.7	24.4	2158
30 MP.H...	48.9	34.8	27.8-37.5	24.1	439
20 M.P.H...	60.9	42.3	39.5-50.0	26.6	343

It is seen from Table I that the average of the fastest 15 per cent of those cars observed outside of restricted zones is slightly less than 50 m.p.h., yet this speed is exceeded in practically all of the restricted areas by this high 15 per cent group. However, the average speed and the pace of vehicles gives a better indication of what the average driver is doing on the highway. It is seen from these figures that as the speed limit approaches 45 m.p.h. that the average driver is inclined to drive somewhat near the limits set by the regulation. In the lower speed limitation the average driver is inclined to drive beyond the limit, thus indicating that he does not always believe the lower speed limits to be reasonable. This is seen from the fact that in the 20 m.p.h. zone the average of the fast 15 per cent drive is 60.9 m.p.h. It must be borne in mind that the speed observations were all made *outside of business districts at points where the usual* 20 *mile restrictions do not apply.*

In Table II are classified the speeds of various types of vehicles and here again it is seen that the average drivers of passenger cars are operating in the vicinity of 45 m.p.h.

TABLE II—SPEED BY TYPE OF VEHICLE

Type of Vehicle	Average Fast 15% M. P. H.	Average 100% M. P. H.	Pace M. P. H.	Average Slow 15% M. P. H.	Total Observations Number Vehicles
Pass. cars...	63.4	45.7	39.5-50.0	30.0	21826
Lt. trucks...	52.2	38.7	31.3-41.7	25.0	3486
Med. trucks.	47.6	34.7	27.8-37.5	21.9	603
Hvy. trucks.	41.5	29.8	27.8-37.5	17.4	151

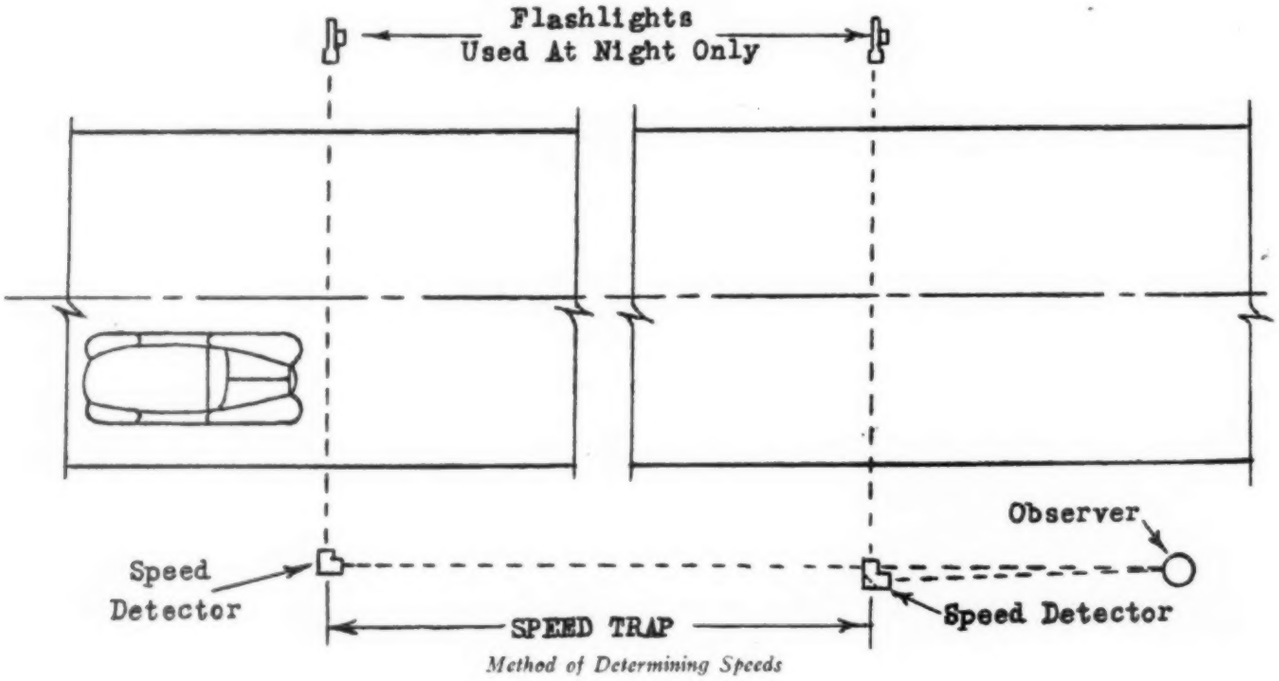
It is somewhat surprising to find that heavy trucks are operating at an average speed of 30 m.p.h. and that the average of the fastest 15 per cent of these vehicles are operating over 40 m.p.h. These observations do indicate, however, that with a differential in average speed between passenger and commercial vehicles that on highways of heavy truck concentrations, a segregation of traffic may be desirable.

Observations were made to determine speeds at various times of the day and are summarized in Table III.

It is found that there is very little reduction in speed during the dark hours. The highest average speeds were, however, recorded during the daylight hours, with the average dropping to 40 m.p.h. during the period from midnight to 3 a. m.

In Table IV speed observations are summarized by days of the week. The maximum average speed occurs on Monday and the minimum on Thursday.

In Table V are recorded the speed according to type of location. It is found that vehicles on an average operate about 5 m.p.h. faster on the state trunk-line system than on country roads, and about 8 m.p.h. faster than on city streets.



Method of Determining Speeds

TABLE III—SPEED OF TIME OF DAY

Time of Day	Average Fast 15% M. P. H.	Average 100% M. P. H.	Pace M. P. H.	Average Slow 15% M. P. H.	Total Observations Number Vehicles
12:00 P. M.- 3:00 A. M.	60.9	39.6	31.3-41.7	23.3	130
3:01 A. M.- 6:00 A. M.			No Observations		
6:01 A. M.- 9:00 A. M.	62.1	45.1	39.5-50.0	31.5	717
9:01 A. M.- 11:00 A. M.	62.2	43.3	39.5-50.0	27.2	4186
11:01 A. M.- 1:00 P. M.	63.8	44.4	39.5-50.0	28.1	4400
1:01 P. M.- 4:00 P. M.	62.5	45.0	39.5-50.0	28.4	9014
4:01 P. M.- 7:00 P. M.	62.9	44.6	39.5-50.0	28.7	5166
7:01 P. M.- 10:00 P. M.	60.7	43.0	39.5-50.0	26.6	2038
10:01 P. M.- 12:00 P. M.	61.9	43.2	39.5-50.0	27.5	332

TABLE IV—SPEED BY DAY OF WEEK

Day	Average Fast 15% M. P. H.	Average 100% M. P. H.	Pace M. P. H.	Average Slow 15% M. P. H.	Total Observations Number Vehicles
Sunday	60.7	43.7	39.5-50.0	28.5	2712
Monday	63.8	45.6	39.5-50.0	29.0	4433
Tuesday	63.1	44.9	39.5-50.0	29.2	4862
Wednesday .	62.9	44.9	39.5-50.0	29.8	3330
Thursday ...	61.2	42.0	34.1-44.1	25.9	3257
Friday	61.4	43.3	34.1-44.1	26.4	3744
Saturday ...	62.6	45.2	39.5-50.0	29.3	3645

TABLE V—SPEED BY TYPE OF LOCATION

Type of Location	Average Fast 15% M. P. H.	Average 100% M. P. H.	Pace M. P. H.	Average Slow 15% M. P. H.	Total Observations Number Vehicles
Straight-away	63.0	44.9	39.5-50.0	30.0	10096
Up grade...	63.3	46.4	{ 46.9-57.7 { 39.5-50.0	29.5	212
Hill crest....	60.4	42.7	39.5-50.0	23.9	349
Down grade.	69.9	51.4	44.1-53.6	35.4	50
Curve	58.0	40.9	34.1-44.1	26.2	1200
Intersection .	63.3	45.4	39.5-50.0	28.7	11298
Entering city	55.0	38.4	31.3-41.7	26.2	1324
Leaving city.	57.5	40.5	31.3-41.7	25.8	767
Built-up area	58.6	40.6	31.3-41.7	26.7	1084
R.R. crossing	54.9	37.6	34.1-44.1	21.5	465
County roads	60.2	40.5	31.3-41.7	25.2	692
U. S. and state roads.	62.9	44.9	39.5-50.0	28.5	23704
City streets.	52.9	37.6	31.3-41.7	24.9	1587

Note:—"Up Grade" under column headed "Pace" both groupings of 10 contained the same number of vehicles.

The observations made on city streets were in all cases near the city limits and most of the observations were made in the vicinity of Detroit where the surrounding territory was not heavily built up. It is noted from the tabulation that vehicles in general passed through intersections at a speed of 45 m.p.h., which is found to be very nearly the average operating speed under all conditions, and it appears that drivers feel safe in negotiating curves at an average speed of 41 m.p.h.

The highest average speed at the locations tabulated was found to be down grade. Drivers apparently ascend grades at an average speed of 46.4 m.p.h., go over the crest somewhat slower at 42.7 m.p.h., and then accelerate down grade to an average speed of 51.4 m.p.h. Drivers in general retard speed upon entering cities and towns to an average of 38.4 m.p.h and pick up speed upon leaving municipalities.

Further analysis will be made of the speed observation data, particularly on the principal routes. A speed map may be developed which will take the general form of a traffic flow map with the width of band indicating the average speed on various sections of roadway. Coordinating these data with traffic volume, pavement width and other physical conditions and accident occurrence should yield some valuable relationships.

For the purposes of this paper, several sections of road were tabulated showing in Table VI the average speed as compared to the average daily traffic volume and the accident experience on that section.

According to the tabulation in Table VI the highest number of accidents were recorded on the section of road having the lowest average speed and carrying the lightest traffic volume. The section having the highest average speed accounts for the lowest number of accidents among the sections under investigation. It would appear from this preliminary investigation that speed and accidents had little relationship and that volume, up to the point of congestion, does not affect the average speed to any greater extent.

Conclusion.—There are several conclusions which may be drawn from the preliminary tables herein presented:

First, that there are a group of people driving on the highway who operate their vehicles at speeds consistently over 60 m.p.h.

Second, that the average driver is operating his vehicle at a speed less than that proposed by proponents of the idea of installing governors on vehicles restricting their operation to 50 m.p.h. or less; and,

Third, that speed is not a strong contributing factor to accidents. It is further concluded that motor vehicle operators are inclined to drive their cars at speeds which

TABLE VI—SPEED, ACCIDENTS AND TRAFFIC BY ROUTES

Routes and County	Average Fast 15% M. P. H.	Average 100% M. P. H.	Pace	Average Slow 15% M. P. H.	Total Accidents 1935	Average Traffic Volume	Total Observations Number Vehicles
U. S. 112—Washtenaw..... 20 ft. pavement..... U. S. 112—Lenawee.....	63.7	47.6	39.5-50.0	33.9	126 8 (K) 65 (I) 53 (P)	3308	246
U. S. 24—Monroe.....	69.7	52.1	39.5-50.0	31.4	33 8 (K) 14 (I) 11 (P)	6087	172
U. S. 24 and U. S. 25—Monroe.....	66.8	49.6	46.9-57.7	35.2	44 8 (K) 18 (I) 18 (P)	8443	90
U. S. 10—Oakland..... 40 ft. pavement.....	66.2	48.2	39.5-50.0	31.8	50 10 (K) 36 (I) 4 (P)	7170	308

K = Accidents resulting in death. I = Accidents resulting in injury. P = Accidents resulting in property damage only.

they feel to be safe under the existing conditions, notwithstanding any posted speed restrictions to the contrary.

It has been proposed in some states to zone highways for speed based upon scientific field investigation, but to do this properly on a system comprising over 8,000 miles of highway would involve considerable time and expense. Any effort in this direction might yield disappointing results in total accident reduction out of proportion to the effort expended. It does appear, however, that speed restrictions should not be posted which are unreasonable and which the average driver will not observe, thus promoting an attitude of disregard to all regulatory signs. It is believed that the average driver operates his car safely and at a speed which is proper. Perhaps enforcement of speed restrictions, above which the average operator drives might tend to bring about a reduction in highway accidents. It is believed that this would result in a greater reduction in accidents than a concentration of enforcement activity on drivers exceeding arbitrary speed determinations that are not based upon speeds which the average driver feels to be safe.

As time and money become available it would be desirable to zone all highways for speeds which are scientifically determined to be safe, reasonable, and proper for the conditions existing. Some recognition must be given to the attitude of the average driver and speed restrictions made to fit what he considers to be safe practice. Sight distances, road conditions, traffic volumes, and roadside development must also be examined in a proper zoning program. With a further study of prevailing speeds and their relationship to accidents and congestion we may look forward to a limited program of zoning highways for speed regulation in Michigan.

The tables and conclusions in this study are only of a preliminary nature and further studies and analyses may bring about entirely different results and conclusions. These studies have pointed to paths of investigation which may throw considerable light upon the related problems of speed, accidents, highway construction and motor vehicle regulation.

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Notes on an Iowa Grading Job

THE picture shows equipment working Sept. 8, 1936 on the approach fill to a 50-ft. concrete arch on Iowa State Route 175 near Ellsworth in Hamilton County. Haul from the roadside borrow pit where dragline is working is about 500 ft. The material is loam and gravel.

C. H. Lowe of Cedar Rapids was the contractor. He operated two 8-hour shifts of about 38 men each. Equipment was as follows:

1 Koehring dragline with 1⅞ yard bucket.
3 Allis-Chalmers 35 tractors hauling.
2 Caterpillar 40 tractors hauling.
5 La Plante-Choate 5 yard crawler wagons, with board extension on one side only, giving a total capacity of 6 yds.
1 Baker bulldozer.
1 Allis-Chalmers 35 tractor bulldozing.
1 McCormick-Deering roller.

This crew and outfit moved and placed from 220 to 225 yards per hour under normal conditions.

The work formed a part of a 17-mile widening and grade reducing job on this route in the summer of 1936.

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STREET NAMES IN LONDON.—There are 127 Church Streets and roads within the whole metropolitan area of London, England. There are 64 streets, squares, roads, avenues and "gardens" in London which bear the name Albert, in honor of the Prince Consort of Queen Victoria. Victoria's name is borne by almost as many streets, roads (there are 26 Victoria Roads alone), squares and buildings. Of Chapel Streets London possesses 37; of Albion Streets, 26; of Albany Streets, 19. And there are Nine Love Lanes.

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LARGE ROAD PROGRAM PROPOSED IN MASSACHUSETTS.—A resolve has been presented in the Massachusetts House of Representatives directing the State Department of Public Works to lay out a program of highway construction and improvement selected from 51 legislative proposals, involving an estimated outlay of $100,000,000, which have been presented to the General Court. The resolve provides that the department submit to the legislature by Dec. 1 of the current year a program covering a five or 10-year period, together with recommendations as to the order in which projects should be taken up, details as to cost, the apportionments of the expense, work maps, etc.

Handling Thirty-seven 6-yd. Loads per Hour With Dragline and Five Wagons—Haul 500 Ft. The Dump is at Low Spot in Middle Ground of Picture.

CINCINNATI STREET MAINTENANCE DIVISION TACKLES FLOOD DAMAGE

By M. A. SMITH

Advertising Manager, Littleford Bros., Cincinnati, Ohio

WHEN the Ohio River left its placid bed in Cincinnati to surge up to an 80 ft. stage, 9 ft. higher than ever before in recorded history, many strange situations arose that required unusual remedies.

At the 73 ft. stage, the city water works had to surrender after valiant efforts. Within a short time, the rapidly rising waters paralyzed the West End generating station of the local electric company. These calamities came in addition to the strangulation of traffic resulting from the cutting off of many of the main arteries out of the basin into the hilltop residential sections.

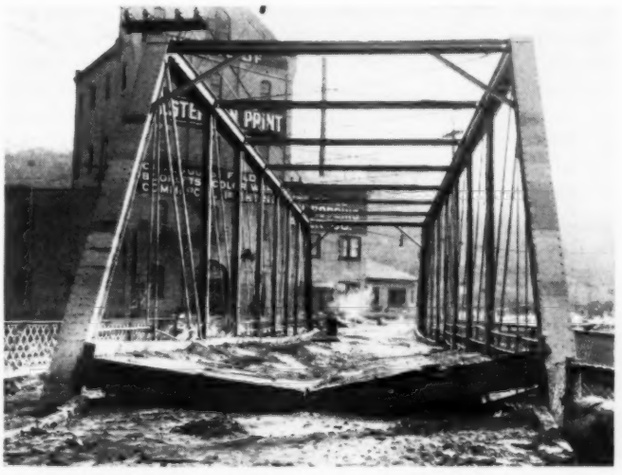
On Sunday—Black Sunday—Jan. 27, Cincinnati found herself in dire straits. Straits of which careful planners, basing their calculations on past performances of the river, had little dreamed, even as outlandish possibilities. Cincinnati was without lights and power. It took three hours to drive from suburbs to the center of the city—normally a 25-minute jaunt over well kept streets. And worse of all, worse than loss of power or of street railway facilities, worse than the danger of a food famine, was the stark reality of thirst. For there was no water in many parts of the city and only a little in the most fortunate sections. And what was available was not fit to drink.

Street Department Handles Drinking Water Problem

Hospitals, restaurants, hotels must have water. Something had to be done. Something was done. And Cincinnatians will long remember the rapidity, the smooth efficiency with which it was done.

The street maintenance division, a closely knit corps of 500 men trained to keep 785 miles of Cincinnati streets, boulevards and byways in excellent condition swung into action. Under the direction of Mr. Chas. Brokaw, head of the department, and Mr. T. J. Montgomery, assistant, this group manned trucks, street flushers and other equipment from units regularly used in their work.

Old Ludlow Avenue Bridge Over Mill Creek. This View Was Taken on January 23, 1937, Before the Crest Was Reached. Later Only the Topchord Was Visible.



Old Ludlow Avenue Bridge After the Flood. Note Highwater Mark, 80-Foot Stage, Near Top of Structure. Although Only One Firm Uses This Bridge, the Maintenance Division Had to Restore the Wooden Floor.

Tanks were erected at hospitals, hotels and centralized locations throughout suburban and downtown residential sections. 1,500 railroad ties were borrowed from the Big Four R. R. yard supply, and used to build cribbing under these water supply tanks.

Neighboring cities, Dayton, Columbus, Cleveland, and others loaned tank wagons and street flushers, 12 units in all, with drivers. These men and 75 others were placed on the city payroll.

All work of distributing the water to these district tanks stations was done by maintenance division men. In addition, they did all policing of the tanks to resist riots which occasionally threatened. Also, this division arranged for sources of supply for the water which was brought in from Norwood and other neighboring cities. Pure water obtained by Division men was delivered by tank cars and spotted at strategic sidings. It was pumped into distributing tanks and some 35 tank trucks to be used for feeding district stations. The trucks, owned by Richter Transfer Co., are usually employed in transporting ready mixed concrete.

So Cincinnati can thank her maintenance division and especially Mr. H. Kranz and Mr. Wilburn Meyer, who superintended this vast program of human service, for meritorious service faithfully performed.

Meanwhile, practically all street maintenance work was suspended. Men not doing water apportioning work were busy doing police duty along with firemen, reserves, regular police and later on, Ohio National Guardsmen.

Flood Damage Estimated at $800,000

Damage to city structures, streets, signs and covers resulting from the flood is estimated at $800,000. This figure includes an extensive amount of sewer cleaning and the repairing of many of the older masonry sewers that caved in under the pressure and ravaging effects of the flood waters.

A number of landslides occurred on hillside streets. These were cleared away without delay. Traffic and street name signs and street markers suffered throughout the flood area. They are being repaired or replaced as fast as possible.

Residents of the Western Hills of the city had the choice of two entrances to the basin during the flood—Hopple Street Viaduct, and the new Western Hills Viaduct. Mill Creek, normally a lazy stream some 40 ft. wide, had swollen to over a mile in width, stopping off the half dozen other avenues crossing it from the basin to Price Hill, Overlook, Fairmount, Westwood, Cheviot and Riverside. To reach Western Hills Viaduct, these suburbanites had to pass through a driveway in the yards of the Cleveland Wrecking Company. This driveway would have been impassable with the continuous stream of traffic in rain, sleet and snow but for the prompt action by the Maintenance Division. Division men built and maintained an old fashioned corduroy road through this driveway which kept traffic out of the mud. There were no stalled cars throughout the entire period of its use.

Thirty-five per cent of the street surfaces covered by flood water were hard surfaced; 65 per cent were macadam. Careful examinations, as waters receded, showed damages were much heavier on the macadam pavements. Five percent of the hard pavements were injured; 10 per cent of the bituminous. Of course, the macadam repairs offer much less of a problem than those to hard pavements.

The three new aluminum 3,000 gal. street flushers (described in July issue of ROADS AND STREETS) and the several older smaller flushers saw continuous duty beginning Jan. 27. During the famine, they distributed drinking water. As flood waters went down, they followed the receding shore line flushing down slimy mud and debris, thus making Ole Man River take back with him much of the disagreeable mess he had left during his rampage.

Part of the Damage to Beechmont Levee. Waters Undermined the Revetment Wall at Left, Breaking and Overturning It. Note Broken Sewers and Water Mains. New Construction Will Seal the Berm Between the Revetment Wall and the Edge of the Pavement. A Spillway Will Be Added.

Southside Avenue in East End, Cincinnati, after the Flood. Scenes Like This with Houses Overturned and Left in the Middle of Streets Among Trees and Debris of All Kinds Were Numerous Throughout the City.

The shut down of power necessitated the closing of the city asphalt plant. As soon as partial restoration of power permitted, several concrete mixers were pressed into service, mixing cold patch material for much needed patches on broken streets surfaces.

Beechmont levee that bounds Lunken Municipal Airport, suffered severely under flood waters. The macadam street running over it to connect suburban Mt. Washington to the eastern end of Cincinnati played a large part in preventing its total destruction. However water pouring over it into the lowlands of the airport washed away certain parts of the revetments on the lower side exposing and damaging telephone cables, gas lines and electric and water mains.

Under consideration now is a well laid plan to reconstruct the levee with a spillway which will allow flood waters to pass over it, should such phenomenal stages ever again prevail, without damage to the levee. This is in the hands of the city engineers at the present time.

Earlier in this article, the valiant efforts of the city water works were mentioned. The East End pumping station officials foresaw bad times in store when the waters first began to rise. As much coal as could be handled was brought in and piled inside the building. Then as flood water surrounded the plant, men from the street maintenance crews worked with water works men to fill and build a wall of sand bags around the station. Seepage was pumped out. Thus the station was able to run full force long after the river had passed the stage at which officials had predicted its shut down.

All WPA projects were stopped during the emergency. Men from these projects were placed on flood duty. Then, after the high waters receded and the immense job of cleaning up was to be faced, over 4,000 WPA men and 300 trucks were concentrated on this vast job under street maintenance supervision.

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FIRST FOUR MONTHS OF WINTER COST MINNESOTA $615,000 FOR SNOW REMOVAL.—Fighting heavier snows than in 1935-1936, the state highway department of Minnesota spent $615,000 battling snow on trunk roads the first four months of the winter, October, November, December and January.

FEDERAL LEGISLATION AFFECTING THE CONSTRUCTION INDUSTRY

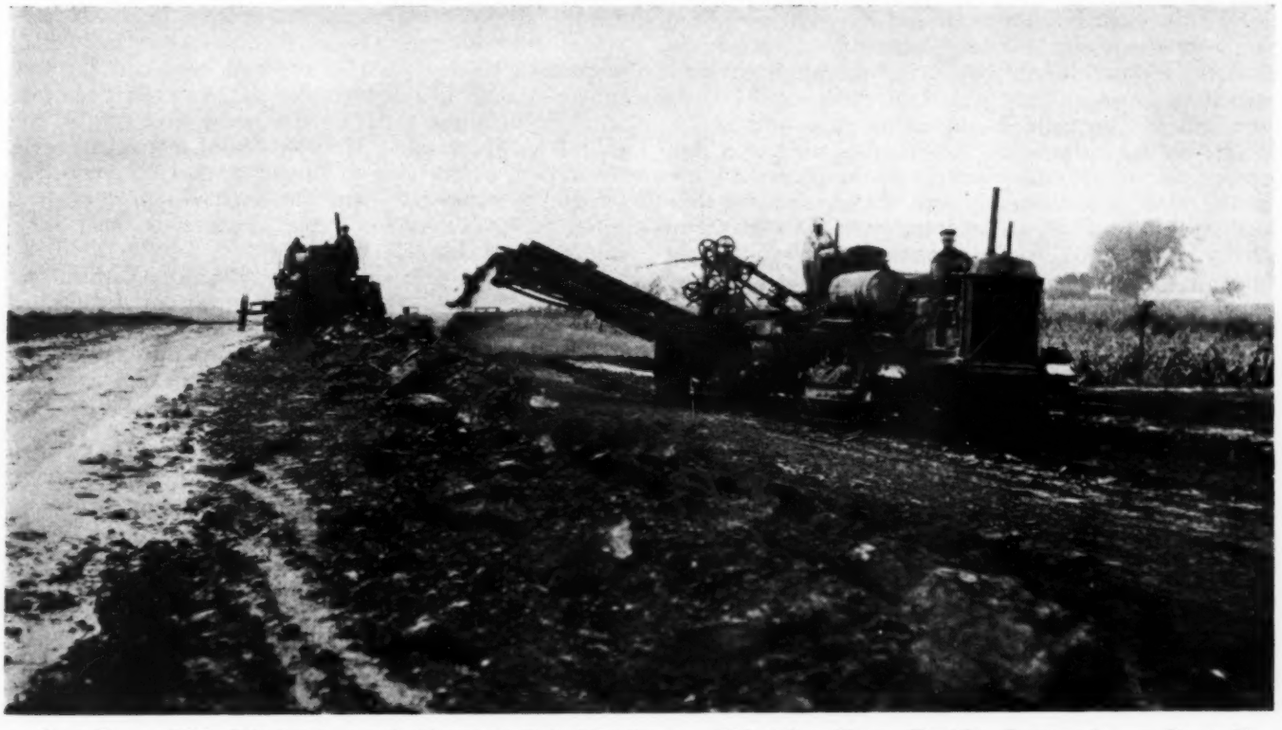
By V. P. AHEARN

Executive Secretary,
The National Sand and Gravel Association

Recent legislation of the Federal Congress is of vital importance to industry. Of particular interest to the construction industry are the Social Security Law, the Robinson-Patman Act and the Walsh-Healey Act. A most interesting discussion of this legislation was given by V. P. Ahearn at the 1937 Convention of the National Paving Brick Association. His paper is presented herewith in full.

WITH the exception of private bills, there is hardly any legislation adopted by the Federal Congress which does not have some degree of effect upon industry. It is evident, however, that the most important statutes adopted by the Seventy-fourth Congress from the business point of view were the Social Security Act, the Robinson-Patman Act, the Walsh-Healey Act, and the surtax on undistributed profits. I shall not attempt here to make a detailed examination of these four statutes, but it will be my purpose to draw certain general conclusions from these laws and to suggest what their significance is for the future. In doing this, I am not unaware of the fact that it is always dangerous to make any definite statements with respect to the political temper, and I also recognize that one is rash indeed who attempts either to discuss recent legislation in definitive terms or to make any predictions as to what the Seventy-fifth Congress will do. What I shall have to offer is only the opinion of one observer of events at Washington, who retains the right to express a different opinion tomorrow.

The function of government was described by one eminent English statesman as being confined to the maintenance of order and the preservation of the sanctity of contractual obligations. Indeed, the dominating theme of our Federal Constitution was that of curbing rather than enlarging the power of government. There are twenty grants of power in the Constitution as compared with thirty-one prohibitions and restrictions. As to certain phases of our economic and social systems, the Constitution denies the national and state governments the right to legislate at all. These are mainly found in the first ten amendments, popularly known as the Bill of Rights. While these were not written into the Constitution adopted at Philadelphia, their incor-



Iowa Favors Wide Side Borrows and Adequately Raised Roadways. This View Shows Shoulder Construction on Route 88 Between Des Moines and Marshalltown in September, 1936. The Pavement Slab Was Completed and in Service.
Photo by Field Editor

poration in our basic law was made by several states a condition precedent to the acceptance of the Constitution. It is puzzling, under these circumstances, to find men in high office deploring the fact that decisions of the Supreme Court of the United States have established a "no man's land of government." That is not an accident of our system of government; it was a deliberate action whose effect was known and intended.

The men who wrote the Constitution and who sponsored its adoption were the recent victims of an excess of governmental power. Their purpose was to establish a real democracy in which the individual, with certain specified reservations, would be supreme. That is the essence of a democratic system. It was recognized that the Constitution should not be made a static instrument, and provision was made not only for adapting the Constitution to degrees of necessary governmental power, but the way was left open for the people themselves to amend the Constitution as circumstances required. It is well to keep in mind that ours is a government of limited powers, and the Constitution is the law enacted by the people themselves. That fundamental law is not subject to the whims and to the passions of temporary majorities in our legislative and executive departments, and they have been circumscribed in the things which they may and may not do. The legislature and executive are our agents and not our principals, and when they discover that new powers are necessary in the public interest, they have a perfect right to recommend to their principals a wider delegation of authority.

Social Security Act

With this as a background, let us examine the legislation to which I have referred. First and foremost must be the Social Security Act. We in industry have never failed to applaud the objective of that legislation. As individuals we have an abiding interest in any undertaking which promises to relieve the evils of destitution and to improve the lot of the unfortunate. If that can be done without disruption of orderly government and if the program can be financed out of the earnings of industry without violently upsetting our whole economic structure, we should, and would, give the social security program our unqualified and enthusiastic support. In a practical sense, however, the Social Security Act must cause sober reflection. The cost of the program begins at $400,000,000 in 1936, increases to more than five times that amount by 1939, and approaches $4,000,000,000 annually by 1950. When the measure becomes fully operative, it will require the annual imposition of new taxes equal to the entire revenues of the Federal Government for the past fiscal year. Yet it is undeniably true that the Social Security Act is probably the most popular piece of legislation enacted in many years, and there is the real possibility that future sessions of our law-making bodies, instead of relieving industry of its present tax burdens under the Social Security Act, may even increase them by higher levies for the purpose of providing larger annuities.

There are grave social implications in the fact that legislation designed to relieve the problems growing out of unemployment and old-age destitution may have the effect of aggravating rather than curing those problems. So long as industry is operating under a competitive system, it must strive toward a constant reduction in its cost of operation. That purpose is stimulated by any legislation which makes employment itself the subject of taxation, and therefore we may expect to see a higher degree of mechanization of industry than has ever been registered in the past.

The social Security Act passed the Congress by impressive majorities and it did not provoke the forming of party lines. I believe it to be permanent legislation barring the single contingency of judicial invalidation. The Supreme Court will soon pass upon the unemployment compensation insurance provisions of the Act which are admittedly less secure constitutionally than the old-age annuity provisions. It is not likely that important changes will be made in the Act at the current session of Congress.

Robinson-Patman Act

The Robinson-Patman Act represents the successful outcome of a concerted drive by groups of retail organizations to eliminate the alleged evils of the chain store system, and yet it is a curious fact that nowhere in the bill is that purpose referred to plainly. In its essential form, the Act narrows the field of allowable defenses to charges of price discrimination. Any price discrimination constitutes presumptive evidence of violation of the Act, but that presumption may be refuted by one of several showings. Certain commercial practices, if indulged in by the producer and the customer, expose the offending party to cease and desist orders by the Federal Trade Commission and to civil suits in the courts for treble damages. Other practices, referred to in an ambiguous and vague manner, are made criminal offenses, subject to a fine of $5,000 and imprisonment.

The Robinson-Patman Act passed the Congress by a comfortable majority in both houses. It was almost political suicide for any member to oppose it, because it was said to be a governmental effort to protect the small businessman. While the courts have always looked with favor upon antitrust statutes which preceded the Robinson-Patman Act, there can be no means of predicting what their attitude will be toward this new enlargement of governmental efforts to prevent monopoly and to punish discrimination. I have no doubt that the average businessman is bewildered by the Act, but he must remember that compliance therewith is an individual and not a group responsibility. As an individual, responsible to his stockholders and creditors, he may suddenly find that a commercial practice heretofore indulged in without having the heavy arm of the law placed on his shoulder, is now illegal, notwithstanding the failure of the Act to say so in specific terms. A thing done innocently and inadvertently may cause a series of civil suits for treble damages, because every injured party can file his claim.

The criminal provisions of the Robinson-Patman Act are to be enforced by the Department of Justice. I believe that the Department will move cautiously and slowly in exercising its powers under the statute, but there is plain evidence that the Federal Trade Commission, notwithstanding the failure of Congress to give it any additional funds to administer the Act, is moving quickly to establish judicial constructions of the civil portions of the law.

It is impossible to give any industry a definitive statement of its obligations and responsibilities under the Robinson-Patman Act, but let me suggest that the principal tests to be applied to any set of facts to determine whether the Act has been violated, are these: (1) Is there a discrimination in price? (2) Is interstate commerce affected? (3) Is the discrimination with respect to goods of similar grade and quality? If not, the discrimination is not unlawful. (4) Did the price discrimination make due allowance for demonstrable differences in cost of manufacture, sale, or delivery?

(*Continued on page 79*)

ADVERTISING PAGES REMOVED

(5) Is the discrimination merely the exercise of a seller's legal right to select his own customers and to refuse to sell to others? (6) Is the discrimination protected by that provision of the Act which gives the seller the right to meet competition? Finally, what is the effect of the discrimination? If it does not (a) substantially lessen competition, (b) tend to create a monopoly, or to (c) injure, destroy, or prevent competition with any person who either grants or knowingly receives the benefit of such discrimination, or with customers of either of them, there is no unlawful discrimination.

With the possible exception of its criminal provisions and those giving the right to the Federal Trade Commission to fix maximum discounts under certain conditions, I believe that the Robinson-Patman Act will survive the constitutional test and that we may expect additional supplementary legislation. Mr. Patman is now engaged in persuading state legislatures to pass state laws patterned after the Act, in order to clear up once and for all the question of jurisdiction over interstate and intrastate commerce. He may press for a bill at the present session which will enlarge the inquisitorial powers of the Federal Trade Commission. There is no evidence that he or other members of Congress will make a strong drive at this session for the bill introduced in the last session whose effect would have been to make illegal the use of the basing point and delivered price systems. If this report is true, it should not be accepted as indicating a permanent policy of not seeking legislation of this character. I believe that it will be revived in the future and that industry is going to have a difficult time convincing the legislators that this bill should not pass.

Walsh-Healey Act

The Walsh-Healey Act, while considerably modified following its original introduction in the Senate, is important mainly because it marked a departure from the traditional Federal custom of awarding contracts to the lowest responsible bidder in a financial sense. With certain reservations, all contracts with the Federal Government now must contain stipulations that the principal contractor will subscribe to an 8-hour day, a 40-hour week, and to wage scales fixed by the Secretary of Labor. Sub-contractors are affected only by the requirement that employees shall not be forced to work in an environment prejudicial to their health or safety. The very scattered opposition to the Walsh-Healey Act in the Congress shows that it is probably permanent legislation, designed to be enlarged as time goes on. It is possible that the $10,000 limitation now contained in the contract may be lowered to $2,000 at the present session, for it is said that in its present form the Act covers only 2 per cent of the number and about 12 per cent of the value of all governmental contracts. An effort will probably be made to include sub-contractors in the labor requirements of the Act, but apparently there is some doubt regarding the constitutionality and the feasibility of this proposal.

The extraordinary volume of Federal purchases today means that the effect of the Walsh-Healey Act will be felt far beyond the fulfillment of Federal contracts. In most industrial operations it is not possible to segregate employees as between those who are engaged on a Federal contract and those who are not, and since there is no doubt regarding the Constitutional validity of the Walsh-Healey Act in principle, this may develop into a rather detailed Federal control over wages and hours in industry.

Surtax on Undistributed Profits

The Revenue Act of 1936 marked the first time that a tax bill was passed without the controlling purpose of increasing Federal income, for the surtax on undistributed profits was aimed at exertion of governmental control over the use of corporation funds after taxes had been paid. The consideration of this measure in both the House and the Senate could not be called an intelligent debate, but it became unsafe politically to oppose it right on the eve of congressional elections.

It is known that the surtax on undistributed profits has aroused a country-wide protest, and the complaints have come principally, it is reported, from small businesses. This will undoubtedly have a real effect in the present session, and it is not unreasonable to expect that modifications will be made in the present drastic law. One suggestion is that corporations be allowed to retain 20 per cent of their profits without being subjected to the punitive tax, to allow for capital improvements and expansions and for the retirement of debt. We who are engaged in the basic industries might well support amendments of the law suggested editorially in the New York Times, from which I quote.

"At present the tax falls upon that portion of a corporation's net income which has not been paid out to shareholders within the taxable year. Most corporations, however, do not know precisely what they have earned during any year until a month or two after the year is ended. Their earnings seldom consist entirely of cash; part of them are in the form of inventories, stocks of goods on hand on which some final bookkeeping valuation must be placed. It is thoroughly unjust to penalize a corporation for not paying out all its earnings until it has at least had an opportunity to know what its earnings are. At present, in their efforts to avoid penalty taxes, corporations run the risk of paying out in dividends more than they have actually earned. The House bill originally carried a provision, later stricken out, in effect allowing 2½ months for corporations to determine their earnings and the amount of dividends they would pay. It is imperative that such a provision should be restored.

"Many State laws prohibit the payment of dividends until any previous impairment of capital has been made good. But the undistributed profits law penalizes corporations for not paying out dividends even when they would violate these State laws by doing so. A complete exemption should be made from the tax of the amount of earnings retained to restore impaired capital.

"Exemption should be granted for some of the surplus retained by corporations in debt. Provision already exists in the law allowing certain narrow exemptions where contracts existed prior to its passage restricting payment of dividends. These exemptions must be substantially liberalized for the sake of fairness to debtor corporations, reasonable protection for creditors and sound corporate management.

"To encourage the retention of at least minimum 'cushion' reserves, a certain percentage of earnings should be retainable by a corporation without any penalty tax at all. Even the Black-LaFollette proposal last Spring, though considered radical at the time, did not impose an undistributed profits tax on the first 20 per cent of a corporation's earnings if retained.

"Some exemption should be made for bona fide reinvestment of earnings in new equipment and new plant. There would doubtless be some administrative problems connected with adequate proof of physical reinvestment.

but such problems are far from insuperable. No doubt are putting their funds back into actual new machinery, Congress would want to put some limit on such an exemption; but the importance of encouraging the physical expansion of American business and employment opportunities should not need to be argued. Corporations that factories and the like are not doing it to 'evade taxation.'

"The present excessive scale of rates on undistributed income should be reduced."

So far as principle itself is concerned, I do not believe that the surtax on undistributed corporation profits will be abandoned at this session of Congress. Excise taxes on selected commodities will be retained where they show an important yield, but nuisance taxes (that is, a "nuisance" to the Treasury Department because of administrative expense) will be discarded. There appears to be no chance of adoption of a manufacturers' sales tax.

Legislative Possibilities

Any safe prediction regarding legislative possibilities at the current session must await a declaration of Administration desires, but prominently among the bills to be considered will be the O'Mahoney Federal Licensing Bill. This would require Federal licensing of all corporations engaged in commerce, which would be defined to include manufacture, production and local distribution. Each license would contain conditions, which in essense, would extend Federal control over wages, hours, and working conditions. Corporation directors would be made trustees for stockholders and at one time Mr. O'Mahoney proposed that the Act include punitive damages for "unconscionable" profits which such directors might secure by means of their power to control the capital of stockholders. Surpluses would have been limited and when dividends exceeded 10 per cent of the par value of the stock of the corporation, the amount over 10 per cent would be divided among employees on a profit sharing plan.

This legislation not only overthrows the plain evidence of judicial construction of our basic law, but even if it were constitutionally sound, one must shudder at the contemplation of the gigantic Federal bureaucracy which the bill would set up. Yet the author of this measure on the floor of the Senate stated that it was designed to secure "self-regulation of industry." Mr. O'Mahoney will not get very far with his measure without Administration sponsorship, but it must be admitted that if the Supreme Court invalidates the National Labor Relations Act or the unemployment compensation insurance provisions of the Social Security Act, the prospects for passage of the O'Mahoney Bill will be considerably increased.

We may expect the usual agitation for the 30-Hour Work Week Bill. There has never been any evidence that the President approves legislation of this type. Mr. Connery, the perennial sponsor of this measure, states that he has cured its defects by providing that notwithstanding the reduction of hours of employment to 30-hours per week, employees shall not suffer a loss of present income. A bureau within the Department of Labor would require the payment of wages adequate for a "decent and comfortable standard of living." While the bill will be strongly supported by certain labor organizations, they may have their tongue in their cheek when they say so. I do not believe this measure will pass.

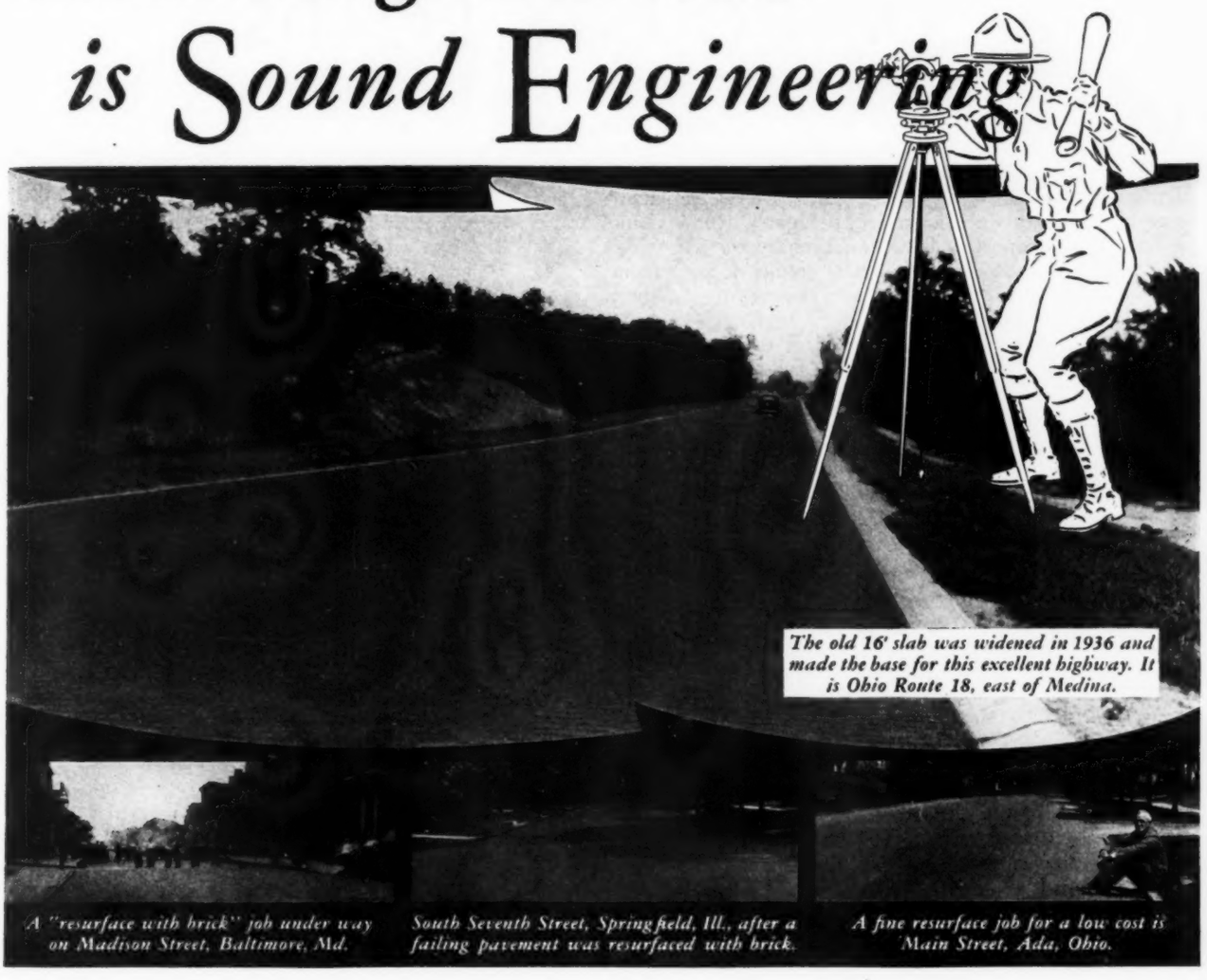
There may be a serious proposal for amendment of the antitrust laws, not intended to change the basic statute but aimed at clarification and definition of our antitrust laws, with particular reference to the Robinson-Patman Act. This proposal may include statutory provision for the holding of trade practice conferences, under the auspices of the Department of Commerce. When so held and approved, members of industry complying with the conference rules would be given immunity against prosecution and enforcement activities by the Federal Trade Commission and the Department of Justice, until such time as one or both of these departments should find that a certain rule in practice constituted illegal restraint of trade. The conference rules would be divided into two groups; the first group would include practices wholly enjoined by statute, and in this group an effort would be made to incorporate minimum wages and maximum hours, observance of which would be binding upon all members of the industry as unfair trade practices within the meaning of the antitrust statutes; the second group would include rules not necessarily illegal, but as to which the industry would be permitted to observe pending a finding of restraint of trade by enforcement agencies. Compliance with this type of rule would not be legally enforceable and would be subject only to contractual agreement.

No important change in the work relief program is expected. The Administration is committed to its WPA policy, on the basis that the direct dole, while the least expensive, is detrimental to public morale and fails to differentiate between those who are voluntarily and involuntarily idle. It is held that a public works program sufficient to provide employment for all worthy employables would be too costly. The net result is a compromise between these two extremes to which the Administration is committed. No scheme of relief has proven to be wholly satisfactory. It is generally recognized that all resorts are inferior to employment in private industry, and unquestionably the lawmaking bodies will endeavor to force that employment by legislative devices. The pressure for such laws will not cease until the Federal Government is relieved of relief expenditures.

The regular Federal-aid highway principle is strongly entrenched in the Congress. There is general recognition that this form of public works has not only furnished considerable employment directly and indirectly, but to a degree not duplicated by other types of construction, adds to the public wealth and is used by all the people.

I do not believe that Congress will pass a new National Recovery Act. In saying this I am referring to the type of legislation which was held invalid by the Supreme Court. There is no possibility whatever of curing or overcoming the constitutional defects found in that act by the Court, unless the Constitution should be so amended as to give the Congress the right to abdicate rather than delegate its legislative functions. I do not fail to recognize, however, that numerous bills will be introduced which are designed to give the Federal Government control over specific industries, such as the bituminous coal and textile industries; but if by a new NRA bill is meant a proposed legislative enactment which would restore the wide control over industry possessed by the Federal Government in the invalidated Recovery Act, I entertain the definite opinion that no legislation of this character will be passed, unless there is some eventuality which cannot now possibly be anticipated.

Resurfacing with Brick *is Sound Engineering*



The old 16' slab was widened in 1936 and made the base for this excellent highway. It is Ohio Route 18, east of Medina.

A "resurface with brick" job under way on Madison Street, Baltimore, Md.

South Seventh Street, Springfield, Ill., after a failing pavement was resurfaced with brick.

A fine resurface job for a low cost is Main Street, Ada, Ohio.

● The sound practice of using worn pavements as the base for new pavements dates back to ancient times. Roman road engineers kept building the new over the old until the succeeding layers were piled high—it gave us the word "highway."

Today, highway engineers are turning failure into success by brick resurfacing all manner of pavements that have become a handicap to traffic and a burden to the public purse.

This done, the community owns a new and modern trafficway at a normal cost and is relieved of future excessive upkeep.

Resurfacing with brick is sound engineering. The settled subgrade is left undisturbed; the old pavement structure has high salvage value as a base. The job is quickly completed with a minimum of interruption to traffic.

Once resurfaced with brick a pavement can withstand the destructive action of *weather* as well as traffic. Thirty years or more of service is not uncommon. For additional information, write National Paving Brick Association, (Affiliated with Structural Clay Products, Inc.) National Press Building, Washington, D. C.

BRICK

FOR NEW AND RESURFACE JOBS

DESIGN AND CONSTRUCTION OF COUNTY ROADS

RECOMMENDED policies in the design of county roads are embodied in the report of the ARBA county committee on design and construction, presented at the 1937 convention of the association by the chairman, L. G. Belknap, engineer-manager of the Oakland County (Michigan) Road Commission. The report is based on a study of 102 questionnaires received from various counties and from previous papers on the subject. The report follows, practically in full.

Five main headings are suggested in connection with standards for county highways as follows:

1. Location.
2. Highway cross-section.
3. Types of surface recommended for the classification of highways as indicated.
4. Types and thickness of base recommended for surface treatments or bituminous materials.
5. Traffic safeguards.

The minimum standards as suggested are for average conditions. In mountainous and thickly developed country, limiting grades, curvature, right-of-way, etc., may be entirely changed due to the economic cost necessary to maintain certain set standards.

It has been found that most counties follow very closely those specifications and standards approved by their respective state highway departments.

County highways have been classified into three general groups according to the importance of the road and also the number of vehicles per day that may be expected to use these roads. The number of vehicles per day is an arbitrary classification and not to be construed as fixing a "rate of use" for each class.

Class A:

Main traveled roads other than State or Federal routes, which serve to connect with towns and other centers of population and carrying 1,500 or more vehicles per day.

Class B:

Secondary roads which connect with local or "farm to market" roads and carrying 500 or more vehicles per day.

Class C:

Local or "farm to market" roads of shorter length and closely related to agricultural service and carrying less than 500 vehicles per day. These latter roads, where traffic is very light, do not justify any great expenditure of funds for improvement, but are here to stay and must be treated as a part of the highway system.

Location

(a) Right-of-way.

Class A:

Reported widths.....40 to 204 ft.
Average widths .....50 to 60 ft.

Super-highways (so-called), which have been built close to large metropolitan centers have in some instances a right-of-way of 204 ft. in width. These have a central parkway 80 ft. wide with two 40-ft. lanes of concrete on either side and perhaps fall in a separate classification. The average highway on main routes, however, may be considered as one 40-ft. pavement with shoulders 10 ft. in width and 20 ft. allowed on either side of the roadbed for drainage, public utilities, landscaping, etc. This highway requires a minimum width of 100 ft.

Class B:

Reported widths.....24 to 100 ft.
Average widths .....50 to 60 ft.

The typical road of this class may be considered as one 20 or 22 ft. pavement or other type of surfacing with 10 ft. shoulders and 20 ft. on either side of the roadbed for drainage purposes, etc. The minimum right-of-way required would be 80 ft. in width.

Class C:

Reported width .....20 to 100 ft.
Average widths .....40 to 60 ft.

It is considered that an 18 ft. traveled surface with 5 ft. shoulders and 16 ft. on either side of the roadbed for drainage purposes, etc., is necessary, then this road would have a minimum right-of-way of 60 ft. in width.

(b) Maximum Degree of Horizontal Curvature.

Class A:

As reported .....3 degrees to 30 degrees
Average .....4 degrees to 10 degrees

This type of highway should be designated for vehicle speeds of 60 miles per hour. The maximum horizontal curvature with super-elevation for this speed may be considered as 5 degrees.

Class B:

As reported .....3 degrees to 60 degrees
Average .....6 degrees to 10 degrees

Horizontal curvature for roads of this class would naturally require not to exceed 6 degrees for high speeds, but no doubt a greater latitude may be used where conditions warrant and it is suggested that 8 degrees be considered a maximum.

Class C:

As reported ..... 3 degrees to 90 degrees
Average .....10 degrees to 20 degrees

The degree of curvature in hilly or mountainous country is so extreme that to suggest maximum would be all out of proportion to average plain or rolling country. These roads do not warrant excessive speeds and it is considered that a maximum 16 degrees of curvature would represent a high average.

(c) Maximum Grades.

Class A:

Reported percentage .....1 to 10 per cent
Average .....5 to 7 per cent

A maximum grade of 6 per cent is not objectional to the modern high speed motor vehicle for highways of this class where adequate sight distances are provided. However, long grades may be the means of slowing down traffic because of the inability of heavy motor trucks to maintain an average road speed.

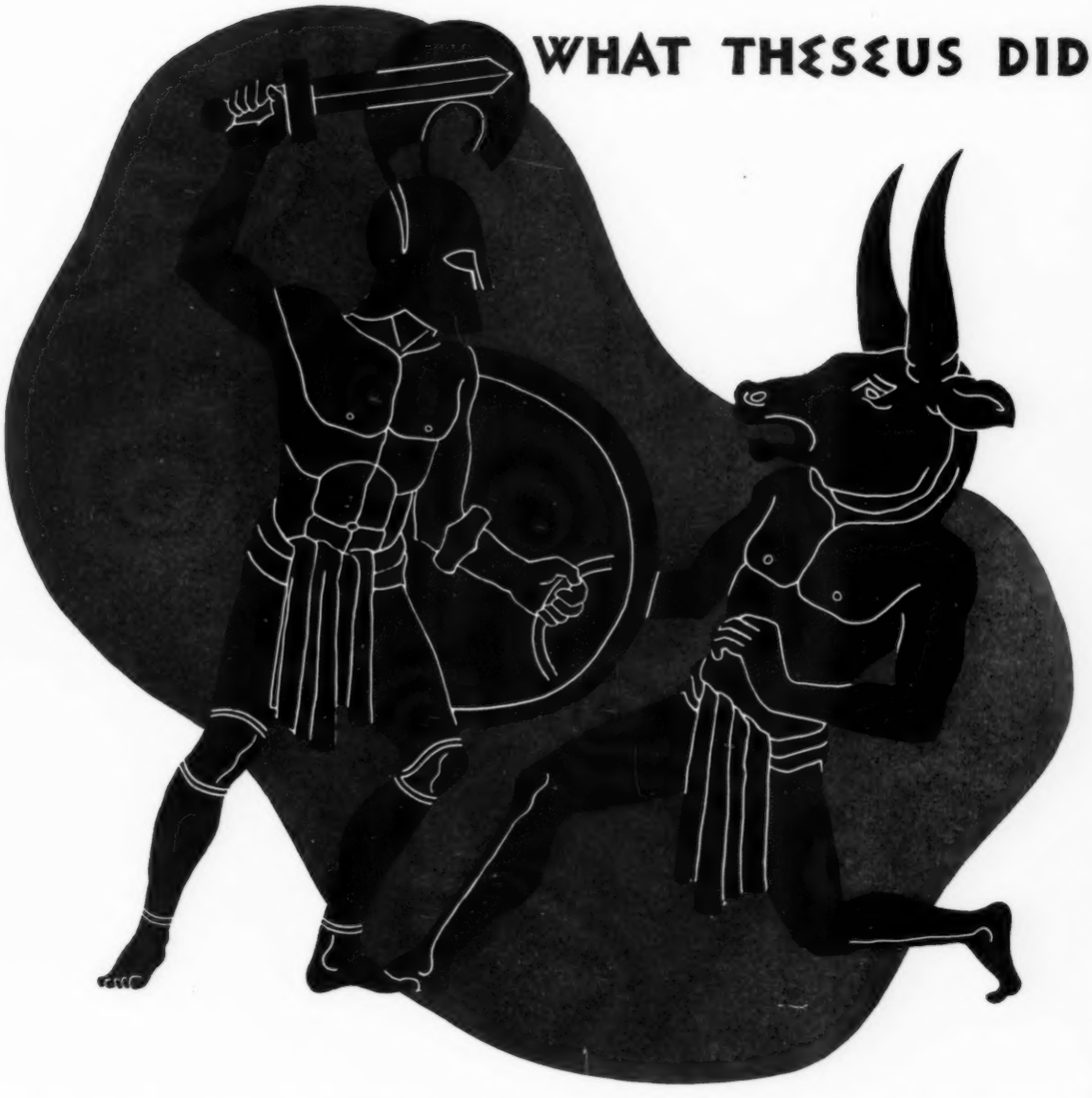
Class B:

Reported percentages.....1 to 12 per cent
Average .....5 to 8 per cent

The maximum gradient with normal vehicles' speed may be considered as 8 per cent. This gradient is not extreme for heavy motor vehicles.

Class C:

YOU CAN DO WHAT THESEUS DID



FROM AN ANCIENT LEGEND comes the story of a monster that once terrorized the island of Crete. To appease its anger the people were required to bring an annual sacrifice of *seven beautiful maidens.*

Year after year this costly sacrifice was paid —without hope of permanent freedom—until brave-hearted Theseus killed the monster and saved his people.

The Problem

Surprising as it may seem, every highway and railway engineer today has a similar opportunity on a much larger scale. For years our country has been "sacrificing" *millions of dollars* to repair the annual damage done by frost heaves, soft spots and sliding fills. Furthermore, unless something is done to *eliminate the cause* of these conditions, our annual maintenance bill is likely to grow higher and higher.

Your Opportunity

Fortunately, the solution to this problem is not difficult because investigations show that fully 80 per cent of all road surface defects are caused by a *wet, improperly-drained subgrade.* Besides, we know from experience that this undesirable condition can be cured permanently and economically by the right kind of *subdrainage.* Here lies your opportunity and Armco engineers are ready to help you achieve it. Armco Culvert Mfrs. Association, 703 Curtis Street, Middletown, Ohio.

Reported percentages.....1 to 17 per cent
Average .....7 to 10 per cent

The "farm to market" roads which do not justify expensive grading operations may be considered as having a maximum gradient of 10 per cent.

(d) Minimum Visibility on Vertical Curves.

Class A:
As reported .....200 to 1,500 ft.
Average .....400 to 600 ft.

Sight distances on vertical curves may vary on two-lane highways from 500 ft. to a minimum sight distance of 1,500 ft. on 3-lane highways. Four-lane highways require a minimum sight distance of 800 ft. A minimum sight distance of 500 ft. is suggested for 2-lane highways with the recommendation that these distances be increased as above whenever future widening is anticpated.

Class B:
As reported .....200 to 1,000 ft.
Average .....300 to 500 ft.

Secondary roads with minimum sight distances of 400 ft. for the average two-lane highway is recommended.

Class C:
As reported .....100 to 750 ft
Average .....250 to 400 ft.

The local roads with restricted speeds would permit of a minimum sight distance over vertical curves of 300 ft., depending on the class of traffic and topography of the country.

(e) Superelevation of Curves.

(1)

As reported—	Class A	Class B	Class C
Maximum Radius.	50 to 5730 ft.	50 to 5730 ft.	50 to 5730 ft.
Average	500 to 1000 ft.	300 to 600 ft.	300 to 500 ft.

It is recommended that all curves be superelevated, although the average practice is to superelevate commencing at 300 to 1,000 ft. radius.

(2) Rates per foot of superelevation vary from ⅛ in. to 2 in. It is recommended that the American Association of State Highway Officials' formula for superelevations be used. The formula is:

$$E = 0.067 \frac{S^2}{R}$$ Where

E = SLOPE in feet per foot of width
S = speed in miles per hour
R = Radius of curve in feet

with a minimum superelevation of .0125 of a foot per foot and a maximum of .10 of a foot per foot.

(3) Additional width of pavement as reported ranges from 1 to 6 ft., depending on the radius of curvature.

Highway Cross-Sections

(a)	Class A	Class B	Class C
Width of Shoulders.....	2 to 12 ft.	2 to 12 ft.	2 to 10 ft.
Average	6 to 10 ft.	5 to 8 ft.	3 to 6 ft.
Recommended	8 ft.	6 ft.	5 ft.

On main routes which are designed for maximum speed the shoulder width should be sufficient to provide for safe parking of vehicles off the traveled portion of the highway. This requires from 8 to 10 ft. of shoulder width. Secondary roads should also provide a minimum of 6 ft. and preferably 8 ft. if conditions permit. Local roads should have a minimum width of 5 ft.

Width and Number of Traffic Lanes.

Reported—	Class A	Class B	Class C
Width	8 to 12	8 to 12	8 to 10
Number	2 to 4	1 to 2	1 to 2

The width of traffic lanes for main routes as commonly reported is 10 ft. with two, three and four traffic lanes.

Divided highways, where traffic conditions warrant with at least a 30 ft. parking area between slabs for cross traffic, will, no doubt, help reduce the increasing toll of loss of life on highways of this type. The minimum requirement for main routes is a 20-ft. pavement with provision for future widening. A 30-ft. pavement, except as a part of stage construction, tends to increase traffic hazards, and this design should be discouraged.

Secondary routes should have a minimum width of 18 ft. for the traveled surface. Local roads in rough country should have a minimum width of 24 ft. from shoulder to shoulder and in northern climates where snow fall is heavy, probably 30 ft. in width to provide a place for plows to discharge snow. It is very difficult to fix standards for this type of road because of the economic features involved.

Slopes Ratio.

The design of slopes for cuts and fills ranges from 4:1 to 1½:1 for earth sections and from ¼:1 to 1½:1 for rock, shale, etc. The minimum on main routes for cuts and fills of an earth section up to 6 ft. should be 3:1 and perhaps 2:1 for cut and fills over 6 ft. Rock section should be governed by local conditions with a minimum slope of ¼:1. Secondary and local roads should have a slope ratio of not less than 1½:1.

Types of Surfaces and Bases

Types of surfaces and bases for bituminous mats recommended for the classification of highways as indicated.

Class A:

The tendency towards a uniform type of surface on main traveled routes is quite evident. Approximately 80 per cent of the replies to the questionnaire prefer cement concrete pavements. The balance are divided between brick, bituminous surfaces of 1½ to 2½ in. in thickness on 6-in. cement concrete or waterbound macadam bases, etc. It is not the intention of the committee to go into the design or construction of surface types since previous reports have covered these phases quite liberally.

Class B:

We find a greater variation in types of surfaces than in Class A roads.

50 per cent of the counties favor road or plant mixes on well established bases.
20 per cent favor cement concrete bases.
27 per cent favor a well graded gravel or a surface treated gravel surface.
70 per cent prefer bases of crushed stone, gravel or waterbound macadam in compacted depths of 8 to 10 in.

In many mid-western counties, as well as in other sections, stabilized gravel is replacing the normal road gravel, both as a surface and as a base for surface treatment. In traffic volume of from 500 to 1,500 vehicles per day the clay stabilized gravel chemically treated is used as a base rather than as a surface.

Class C:

In the class of highways carrying less than 500 vehicles, the type of surface depends more or less on the availability of local materials. Natural soil roads treated or untreated are entirely adequate from an economic standpoint. Earth surfaces do not keep the mail carriers and others out of the mud during certain seasons of the year. In this class we find over 50 per cent of

"SLIPPERY ROADS BENEATH US..

12 TONS OF MILK BEHIND US . . . CURVES AHEAD"

by Lowell Thomas

"We had just topped the brow of Deadman's Hill—not many miles from my farm in the Taconic Mountains. Down we started! A steep grade. A road slippery with mud. Sharp curves ahead.

"Here was one of the danger spots on that devil stretch through the mountains.

"I had visions of a skid. A blow-out. There were thrills at every curve. But to the driver, Larry Edwards, this mountain run is old stuff.

"He drives one of the 96 giant milk trucks owned by H. L. & F. McBride of Goshen, N. Y. They pound the highways night and day, seven days a week.

"On these runs a skid is mighty dangerous. A flat tire means an hour and a half lost. A blow-out . . . ?

"Tire trouble used to come often. Too often for safety. But, they tell me, with Goodrich Triple Protected Silvertowns, they've never had an accident caused by tires! Not one sidewall blow-out!

850,000 MILES A YEAR

"Later I talked to H. L. McBride. He said, 'Our trucks travel about 850,000 miles a year. Loads are heavy. The country is hilly. Many roads are high crowned. But tire trouble is practically a thing of the past. Our Goodrich Tires average better than 58,000 miles.'

"There's a hauling job of the hardest kind—and there's a tire record that speaks for itself."

* * *

Lowell Thomas, world traveler, adventurer and farmer, found a new thrill in visiting this big scale trucking operation. He heard an amazing story of tire performance. What's back of this record? Well, here are the facts.

Goodrich knows that 8 out of 10 premature truck tire failures are sidewall breaks. Goodrich decided to *do something* about it.

TIRES NOW TRIPLE PROTECTED

Engineers worked for months. Brought out a new invention—Triple Protection. Built into the sidewall, it keeps tires young. Lets 'em wear out S-L-O-W-L-Y instead of blowing out in a hurry.

Here are the three points of dollar-saving Triple Protection:

1. **PLYFLEX**—distributes stresses throughout the tire—prevents ply separation—checks local weakness.
2. **PLY-LOCK**—protects the tire from breaks caused by short plies tearing loose above the bead.
3. **100% FULL-FLOATING CORD**—eliminates cross cords from *all* plies—reduces heat in the tire 12%.

There's something for every trucker to think about. It means sure protection against unnecessary road delays. Goodbye to big repair bills. More mileage than ever built into a truck tire before.

For tire information see a Goodrich dealer or write The B. F. Goodrich Company, Akron, Ohio.

Goodrich *Triple Protected* **Silvertowns**

SPECIFY THESE NEW SILVERTOWN TIRES FOR TRUCKS AND BUSES

the counties favoring crushed stone, gravel or stabilized gravel surfaces or oil earth treated surfaces.

Traffic Safeguards

Guard Rail.

The trend is to stronger and more substantial guard rail where necessary as shown by returns from questionnaires. There were approximately a dozen different types named as being in use including concrete, metal bands, steel shield spring guards, cable and numerous others. Of these 25 per cent of the counties use cable guard rail, 12 per cent use some type of metal band and 11 per cent use wooden guard rail. The committee strongly urge the elimination of all wooden types of rail and the replacement with low, strong durable metal or cable types, effective enough to prevent car from overturning or leaving the road. As an indication to traffic of other hazards along the highway wooden posts without rails are suggested.

Center Line Marking.

The necessity for segregation of traffic into traffic lanes is becoming greater each year, due in particular to increased speed of cars, and volume of traffic. Some 45 per cent of the counties contacted indicated the use of center line or divisional markings. There was little indication of permanent center line markings other than bituminous filled longitudinal construction joints in concrete pavements.

The installation of permanent traffic markers at the time of construction of pavements, both concrete and bituminous, is recommended. Where longitudinal construction joints have not been used or traffic divisions built into the highway traffic lanes should be marked with white unbroken lines 4 to 6 in. in width. The use of different colored paints at such places as curves, steep grades, and points of short sight distances as an aid in directing traffic is more or less in the experimental stage. There is little indication that this type of marking is used to any great extent on county highways and the non-uniformity of such markings from place to place does not make for safer driving for the none too well informed driver.

Warning Signs and Signals.

The standardization of warning signs and signals is clearly noted by the fact that 75 per cent of counties contacted showed the use of warning signs as recommended by the U. S. Bureau of Public Roads, and that of these counties 54 per cent use the reflectorized type to some extent. Since traffic control must be considered from a national viewpoint rather than local, too much emphasis cannot be placed on the necessity for uniformity of signs and signals. Similar type of "stop and go" lights, colors and locations of same tend to eliminate confusion in the mind of the automobile driver. There has been a decided increase in the number of "stop and go" lights for important intersections, with 60 per cent of the replies from the counties favoring time control types and flasher types for less important intersections.

Although the full or semi-automatic signal is used to a much lesser degree than the time control, nevertheless the use of these types of signal is decidedly increasing.

Reflectorized RR Crossing Signs.

Most states in the Union have laws which govern the marking of railroad crossings. A number of states in the past few years have passed further laws regulating types and locations of such signs.

The state of Michigan is one of such states which has realized the necessity for uniform and well defined warnings for motorists approaching railroad crossings. The laws passed have required that every railroad crossing in the state out of municipalities be indicated by reflectorized cross-buck signs or flasher signals naming the railroad and number of tracks to be crossed and that all crossing signs must be erected by Jan. 1, 1937. Advance railroad warning signs are also placed in conspicuous places approximately 300 ft. from the railroad crossing. Returns from questionnaires show 50 per cent of the counties using reflectorized railroad signs and here again the committee would emphasize strongly the necessity for uniformity of signs.

Direction and Mileage Signs.

As traffic has increased so also has the necessity for direction and mileage signs. The types of signs used vary from county to county. However, the trend toward the use of such signs is definitely shown in the reports. Over 70 per cent of the counties use direction and mileage signs. Here again signs placed at vantage points and with letters of legible size make for safer travel for the motorist.

Recommendations and Conclusions

(1) Right-of-way should be sufficiently adequate for future expansion of road facilities and of extra width at all dangerous intersections and railroad crossings.

(2) Grades should be established that conform to the topography of the country with reasonable safety and convenience to the type of traffic using the highway.

(3) Adequate drainage is essential.

(4) Roadbed of sufficient width to serve the volume and speed of traffic anticipated and provide for parking of motor vehicles for repairs.

(5) Safety to be stressed in alignment such as elimination of sharp turns and providing for easy curves to conform to speed of traffic.

(6) Local or "Farm to Market" roads need improvement.

(7) Vertical curvature should not be combined with horizontal curvature.

(8) Transition curves should be used between tangents and circular curves to reduce abruptness of change in superelevation.

(9) Roadways should be developed to provide for landscaping and other general improvements in appearance should be made to conform with the general character of adjacent country.

(10) Soil stabilization should be encouraged for use as road surfaces or bases for surface treatments.

(11) Development of smooth, non-skid surfaces on well-established base material is essential to modern traffic.

(12) Deep drainage ditches should be replaced by wide, shallow ditches with flat slopes or replaced with underground drains.

(13) Sidewalks should be constructed for pedestrian traffic, of any appreciable amount.

(14) Placing of uniform signals and other traffic control devices should be a part of well designed highways.

(15) Grade crossings should be eliminated wherever density of traffic requires and adequate funds permit.

for YOUR 1937 REQUIREMENTS

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✓ EXTRA CAPACITY
✓ LESS MAINTENANCE

Greater Reduction in One Process

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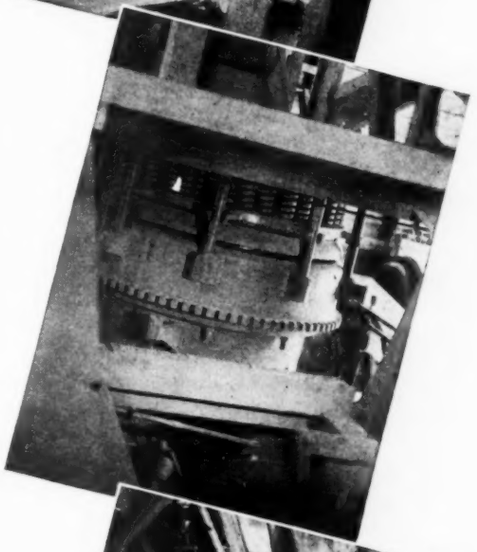
A super-strong, all steel, force feed jaw crusher. Cylindrical roller bearings give higher speed and larger output . . . reduce frictional loss . . . consume less power. Three toggle settings give greater reduction at coarse or fine adjustment. Six sizes. *Write for Bulletin W-3.*



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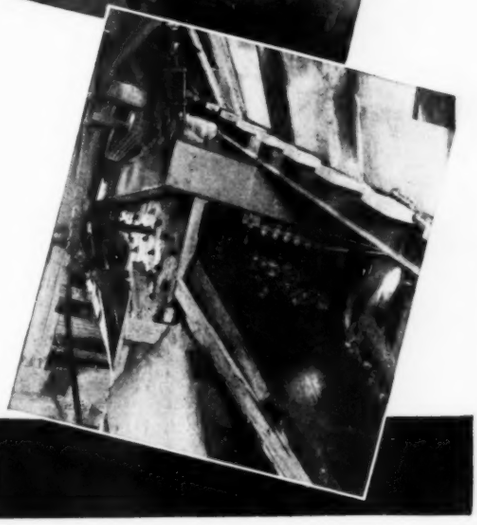

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Screens sand, gravel, crushed rock, ore or coal . . . wet or dry . . . efficiently. Maximum screening action . . . uniform on every inch of the wire . . . on every deck . . . under any load. Better built for a longer life of heavy-duty, low up-keep service. *Write for Bulletin V-3.*

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MC-6

TELSMITH

RECOMMENDED POLICIES IN THE DESIGN OF COUNTY ROADS

	Class A	Class B	Class C
1. Right-of-way minimum.	100 ft.	80 ft.	60 ft.
2. Horizontal curvature—maximum degree	5 deg.	8 deg.	16 deg.
3. Grades—Maximum	6%	8%	10 %
4. Slight distances—minimum	500 ft.	400 ft.	300 ft.
5. Superelevation of curves	Minimum .0125 per ft. Maximum 0.10 ft. per ft. American Association of State Highway Officials' formula.		
A. Radius of curves...	Superelevate all curves		
6. Shoulders — Widths, minimum	8 ft.	6 ft.	5 ft.
7. Traffic lanes—Width...	10 ft.	9 ft.	24 ft. roadbed
Number	2	2	1
8. Slopes ratio—cuts and fills—Earth	3:1 min. up to 6 ft. 2¼:1 min. over 6 ft.	1½:1	1½:1
Rock, shale, etc.....	¼:1 cuts 1½:1 fills	¾:1 1½:1	¼:1 1½:1
9. Type of surface.....	Pavement	Pavement or all-weather surface	Graded stabilized gravel

▼

Highway Safety Study

A comprehensive program of research into the causes of highway accidents is now under way according to a report to Congress by the Secretary of Agriculture on work being done under an authorization of $75,000 for safety studies made at the last session of Congress.

The Bureau of Public Roads, acting for the Secretary of Agriculture, is cooperating with nationally recognized agencies in the field of highway safety in attacking the problem on numerous fronts.

Particular attention is being given three phases of the highway safety problem: (1) Detailed study of the lack of uniformity in State motor-vehicle laws, which is regarded as an important contributing cause of highway accidents; (2) Study of the characteristics and habits of drivers and identification of dangerous drivers; and (3) Improvement of the basic data, needed for the study of accident causes and prevention. Accident reporting is to receive particular attention.

All available information relating to drivers is being collected for study. A digest of the results of previous research is expected to throw light upon means of detecting those personal traits that predispose individual drivers to accidents and that point to means of controlling drivers with such traits.

The Bureau reports that the accident expectancy of the average driver is one accident in about 25 years. Therefore, drivers who have accidents more frequently should be detected and watched. One step in this direction will be the collection and study of accident records of 25,000 drivers over the past 6 years. This study will reveal what percentage of drivers menace the safety of themselves and others. It also will show whether data now collected furnish an adequate basis for predicting the driver's future performance.

Physical and psychological tests of drivers also are to be made to measure skills assumed to be essential to safe driving. By measuring the skill and driving ability of numerous drivers, and comparing the results with their accident records, it may be possible to develop methods that will positively identify safe and unsafe drivers. Such methods could be used by authorities in issuing, suspending, and revoking driver permits.

The Bureau of Public Roads expects a study of the case histories of nummerous serious accidents to disclose valuable information. Close scrutiny of fundamental factors involved in highway accidents should point out what corrective measures are needed. When causes of past accidents are better understood, the necessary regulatory and enforcement provisions can be made to help prevent future accidents.

Immediate investigation of accidents by trained police squads at the scene of their occurrence has proved its value in many cities. Such investigations are to be made on a State-wide scale in Michigan to develop improved procedure in the preparation, analysis, and use of accident data.

A serious stumbling block in accident prevention work is the lack of adequate data concerning accidents. Reports of accidents, if made at all, often are sketchy and incomplete. Adoption of uniform laws to guarantee complete and accurate reporting of all accidents, and adoption of adequate filing systems to make the records readily available for use, will be encouraged.

The Secretary's report says that adoption by all States of a Uniform Motor Vehicle Code of 5 acts—formulated by the National Conference on Street and Highway Safety and recommended for adoption by the States—would be an important step in promoting highway safety as well as facilitating movement of highway traffic. Existing State laws are being compared with the 5 acts of this uniform code.

Traffic accidents and fatalities have reached proportions that place them in the front rank of critical national problems. They involve not one but a whole series of causes and conditions which, to be remedied, must first be understood. The ultimate solution of the problems involved will call for the best efforts and cooperation of all drivers as well as local, State, and national authorities.

An advisory committee has been formed to assist in conducting the work. This committee is composed of representatives of the National Bureau of Standards, Highway Research Board, Yale University, Iowa State College, Harvard Bureau for Street Traffic Research, National Safety Council, American Automobile Association, American Motorists' Association, Automobile Manufacturers' Association, Chamber of Commerce of the United States, Society of Automotive Engineers, National Bureau of Casualty and Surety Underwriters, and American Association of Motor Vehicle Administrators.

Other agencies cooperating are the Division of Anthropology and Psychology of the National Research Council, the Connecticut Department of Motor Vehicles, the Michigan State Police, and the International Association of Chiefs of Police.

▼

H. G. Sours Now With Truscon Steel

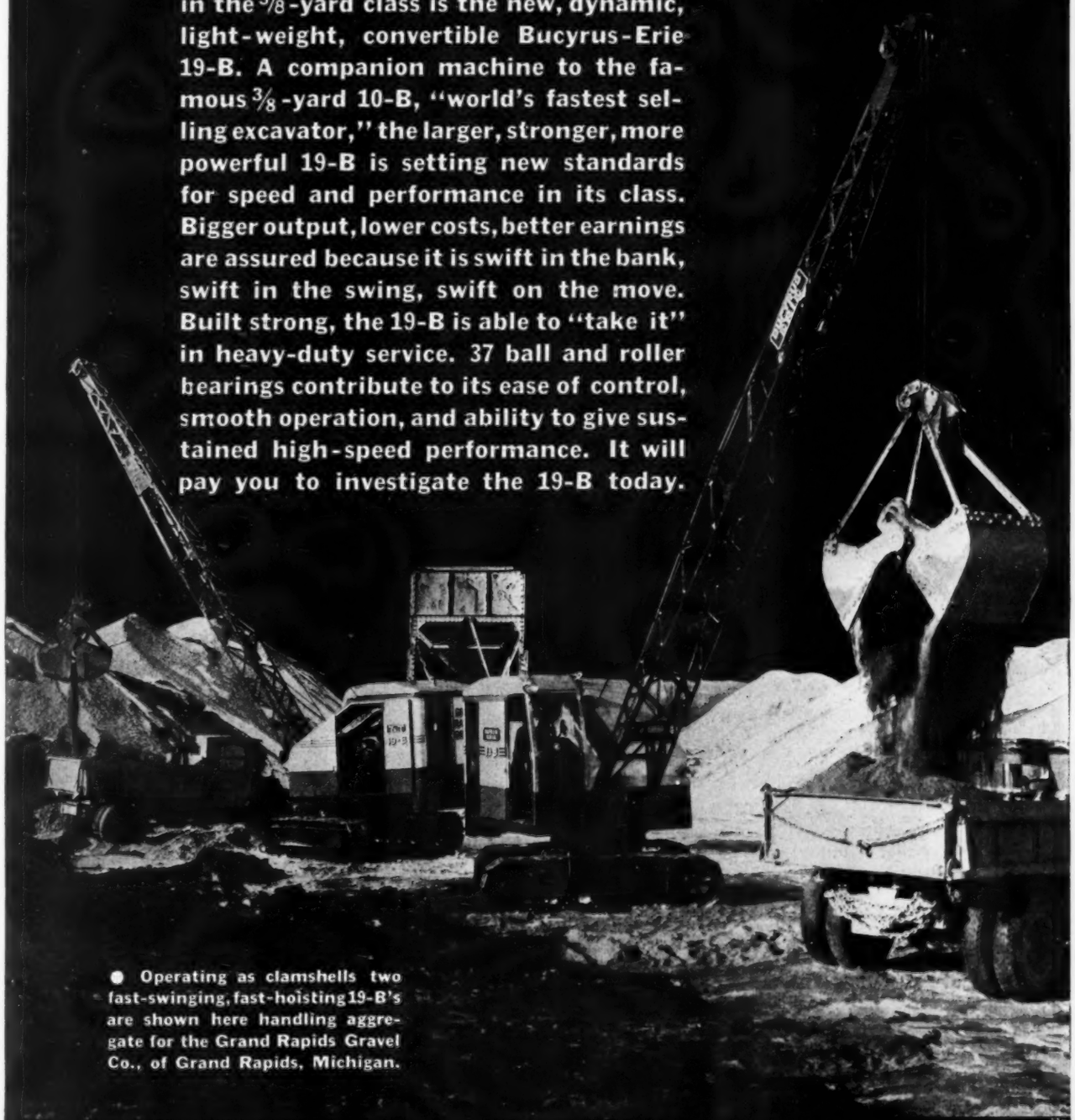
H. G. Sours, Assoc. M. Am. Soc. C. E., has joined the Highway Division of the Truscon Steel Co., Youngstown, O. His work will be principally promotion of highway products, such as welded steel fabric, bar mats, steel road forms, expansion and contraction joints, steel guard rail, and the various other highway products which are manufactured by Truscon. The territory includes the entire United States. Mr. Sours was for many years county engineer of Summit County, Ohio. He has been president of the County Division of the American Road Builders Association and at present is a member of the board of directors of this association.

ADVERTISING PAGES REMOVED

BUCYRUS-ERIE

a 1937 Winner

in the 5/8-yard class is the new, dynamic, light-weight, convertible Bucyrus-Erie 19-B. A companion machine to the famous 3/8-yard 10-B, "world's fastest selling excavator," the larger, stronger, more powerful 19-B is setting new standards for speed and performance in its class. Bigger output, lower costs, better earnings are assured because it is swift in the bank, swift in the swing, swift on the move. Built strong, the 19-B is able to "take it" in heavy-duty service. 37 ball and roller bearings contribute to its ease of control, smooth operation, and ability to give sustained high-speed performance. It will pay you to investigate the 19-B today.



● Operating as clamshells two fast-swinging, fast-hoisting 19-B's are shown here handling aggregate for the Grand Rapids Gravel Co., of Grand Rapids, Michigan.

BUCYRUS ERIE

EXCAVATING, DRILLING, AND MATERIAL HANDLING EQUIPMENT... SOUTH MILWAUKEE, WISCONSIN, U.S.A.

OBSERVATIONS BY THE WAY

By A. PUDDLE JUMPER

¶ The engineers' registration bill now pending in the Illinois Legislature appears to deserve the general support of the profession.

• •

¶ It has been a difficult bill to draw and a few details are still under consideration in committee. When these are worked out the measure should serve admirably both to protect the public interest and to strengthen the position of all competent engineers.

• •

¶ Strong union labor opposition to the act developed because, as originally drawn, it prohibited locomotive, drivers, stationary engine operators and certain others in similar positions from calling themselves "engineers," and because it militated against them in other ways.

• •

¶ The justice of these objections was realized and the defects were cured by the specific exemption of these occupations from the provisions of the act. But many union members, and even whole Locals, have not yet learned that this was done, and are still in active opposition. You can render a valuable service by calling the attention of union engineers to the changes.

• •

¶ Seventy-two thousand persons in Minnesota depended for their living, during at least part of 1936, upon highway employment, and more than 55 per cent of all men placed on jobs by the National Re-employment Service in Minnesota were put to work on road projects.

• •

¶ Doctors say that a sunny disposition promotes digestion, and that more effort is required to frown than to smile. We wonder then how highway traffic enforcement officials get so chunky.

• •

¶ What's all the wailing about in West Virginia regarding trucks not paying their fair share of motor vehicle taxes?

• •

¶ In some cases in the past equipment manufacturers have placed only their trade names on their equipment. When the unit gets to be several years old, trade names are changed and identity becomes lost. Why not put on a plate showing company name and address as well as trade name?

• •

¶ Roy W. Crum, Director, Highway Research Board, asks some pertinent questions on safe driving. Says he:

"What and how to teach is now the problem. Professor Nyhart of Pennsylvania State College, now with the American Automobile Association, has demonstrated that good teaching produces safe drivers. The problem is one of ways and means; what agencies should give the instruction? Where should it be given? How should a tie-in with the licensing authority be affected? What provision should be made for practice grounds? Before anyone can attempt to answer these questions, a fact finding survey should be made of existing information and practices with respect to teaching and licensing motor vehicle drivers."

• •

¶ Believe It or Not—

There used to be a manufacturer of concrete mixers named O. U. Miracle.

Jack Frost does not stick to a window pane, but to selling construction equipment.

• •

¶ H.R. 1964, introduced in Congress by Representative Taylor, Tennessee, provides for the authorization of an appropriation of $100,000,000 or so much thereof as may be necessary, to locate and construct through the states of Virginia, North Carolina, Tennessee, Kentucky, and West Virginia, and the District of Columbia, a highway to be known as Eastern National Park-to-Park Highway. The bill was referred to the Committee on Roads.

• •

¶ In 1934, a depression year, the state highway departments alone spent $11,295,000 for road equipment and machinery.

• •

¶ In Kentucky the County Court has charge of county road work. The county is divided into magisterial districts where the magistrate has charge of lesser roads.

¶ If you are interested in a good, analytical report on accidents on the highways ask "Jimmy" Burch, North Carolina State Highway Dept. for a copy of his analysis of N. C. Rural Motor Vehicle Accidents covering the period June-December, 1936, incl.

• •

¶ It was a good New Hampshire Yankee who said, "Up here we always figger to keep the outgo a leetle smaller than the income." Not a bad fiscal policy for anyone.

• •

¶ In England, during the years 1509 to 1547, in the reign of Henry VIII, a statute conferred powers on civil authorities designed to protect areas against floods which read as follows:

"Such as have walls or banks near unto the sea and do suffer the same to decay, whereby the water entereth and drowneth up the country, shall be apprehended, condemned and staked in the breach where they shall remain forever a parcel of the wall." Pretty tough then, eh what?

• •

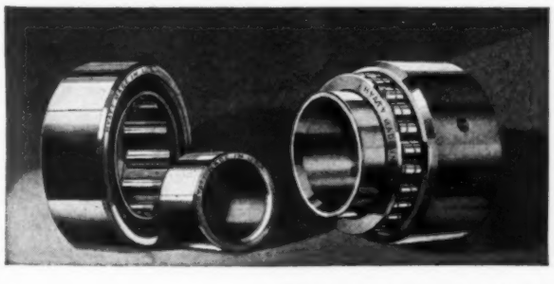
¶ I thought the following would be interesting; it was taken from a speech made by The Honorable Ernest G. Draper, Assistant Secretary of Commerce, at Philadelphia, on January 14, 1937:

"Our own house appears to be rapidly getting in order. The purchasing power of the farmer at the end of 1936 had reached the highest level since 1925. The steel industry is working at 75 per cent of capacity, and wages are 17 per cent above the 1929 level. In the railroad industry, we have run into the first car shortage since 1923, and the roads will have to buy 150,000 cars during 1937. In 1936 net profits of corporations increased 60 per cent over 1935 profits. Add to this the fact that our population has increased by nearly 5 million new consumers since 1929, that industry is gradually absorbing unemployment, and that the purchasing power of the country has never before been so widely distributed, and we have every reason to believe that national recovery is an accomplished fact."

P & H 1½ YARD GASOLINE SHOVEL built by Harnischfeger Corporation, and Hyatt equipped to eliminate bearing wear and tear and care.

Speeding OPERATION TOWARDS NEW ECONOMIES

HYATT
ROLLER BEARINGS



TODAY'S insistent demand for dependability in modern road building equipment is capably met by the indisputable advantages of fine workmanship and fine materials that identify every Hyatt Roller Bearing.

Built of the strongest bearing steel it is possible to procure...machined to microscopic tolerances which bring precision to the highest possible degree...every Hyatt has the exceptional ability to assimilate the gruelling punishment imposed by heavy loads and high speeds, while maintaining a constant and correct alignment of related parts.

Used in shovels, rollers, graders, mixers, and other equipment, Hyatts offer almost limitless possibility for economy in design and operation. Hyatt Bearings Division, General Motors Corporation, Newark, Detroit, San Francisco. Hyatt Roller Bearing Sales Company, Chicago and Pittsburgh.

¶ In Michigan the state highway department has its own maintenance organization in 41 counties of the state while in the other 42 the trunklines are maintained under contract with the county road commissions.

• •

¶ Oregon, too, has just sent in its latest biennial report dealing with the period July 1, 1934, to June 30, 1936, incl. The report estimates 1937 prospects and in the discussion struck a blue note. It states that as a result of having to obligate 1937 funds in 1936 in order to take advantage of all federal aid offered, the department will go into the 1937 construction year with approximately $1,750,000 of its 1937 income already pledged. This will force postponement to 1938 of some $2,000,000 worth of federal aid work that would otherwise have been done in 1937. A welcomed inclusion in Oregon's report is the tabular and explanatory matter regarding county and market road systems. A discussion of who has jurisdiction of county road work might well have been added.

• •

¶ Professor Roger L. Morrison, at the recent convention of the National Paving Brick Association: Mr. Chairman and Gentlemen: Aside from the matter of highway safety, I am quite convinced that my own personal safety can best be insured by being extremely brief. I have a perfectly swell two-hour speech in my system, but you are going to be spared from hearing it. I shall confine my remarks, with the Chairman's permission, to three short statements.

The first is that every single day there is an average of more than one hundred people killed in traffic accidents in this country; somewhere between three thousand and four thousand are injured, and, at a conservative estimate, the cost of these accidents every single day would pay for one hundred miles of brick pavement.

The second statement is that this condition is getting worse all the time. In 1935 there were fewer cars registered than there were in 1930, but there were nearly twenty-five per cent more deaths—a decrease in cars and presumably a decrease in mileage (I did not look up gasoline statistics), and a twenty-five per cent increase in deaths, seven thousand to be exact.

The third statement is that if the parents of children under ten years old would make those children stop running out between parked cars, if children between eleven and sixteen years old would stop roller skating and riding bicycles on the pavement and hitching on trucks, if persons between seventeen and around forty years of age would stop getting liquored up and driving sixty to one hundred miles an hour after midnight, and if the darned old fools my age and older—this is the worst of all — would stop wandering across the streets between the intersections after dark, our problem would practically disappear.

• •

¶ High lights of Jimmy Burch's accident report show causes of accidents are:

1. Driver, 73 per cent; Highway, 12 per cent; Miscellaneous, 15 per cent.

2. Ten per cent of reported accidents occurred at highway intersections and an additional 8 per cent at private driveways.

3. On an average, there were reported two causes for each reported accident.

• •

¶ An equipment distributor recently complained to me about a practice that he thinks is unfair. He says a certain contractor in his area requested different distributors and factory sales representatives to demonstrate their equipment on his job. He got the work done and bought no machine. This thing should not be done and there should be, it seems to me, an agreement amongst distributors and manufacturers that a charge will be made for a demonstration in cases where the party requesting a demonstration does not purchase a machine.

• •

¶ Fifty-six Minnesota motorists were arrested for drunken driving by state highway patrolmen in February, according to a report by Chief John P. Arnoldy to N. W. Elsberg, state highway commissioner, as compared to 16 in February, 1936. Convictions resulted in every case. Mr. Arnoldy explained the increase of 40 arrests over the same month a year ago through co-operation of county attorneys in every part of the state. A year ago a patrolman sometimes hesitated to charge a motorist with drunken driving and placed a lesser charge against offenders. Now straight charges of drunken driving are being placed where evidence warrants them and careless driving charges where liquor is involved. Members of the patrol believe rapid strides are being made in clearing highways of drunken drivers. It was announced last week 44 drivers' licenses were revoked in February, practically all of them for drunken driving. Good going, Arnoldy. That will help make our highways safer. Wheels in the head are not properly geared to wheels in the car.

• •

¶ From the Michigan Highway Condition Bulletin:

DRIVE SAFELY!

As a result of recent thaws and continued moderate temperatures, the shoulders bordering many of the state trunklines have become soft and dangerous to drive upon. During the preceding cold months when the earth was frozen, motorists frequently drove off the pavement or hard surface of the roadway onto the shoulders with perfect safety. To do so now is very likely to result in more or less serious trouble.

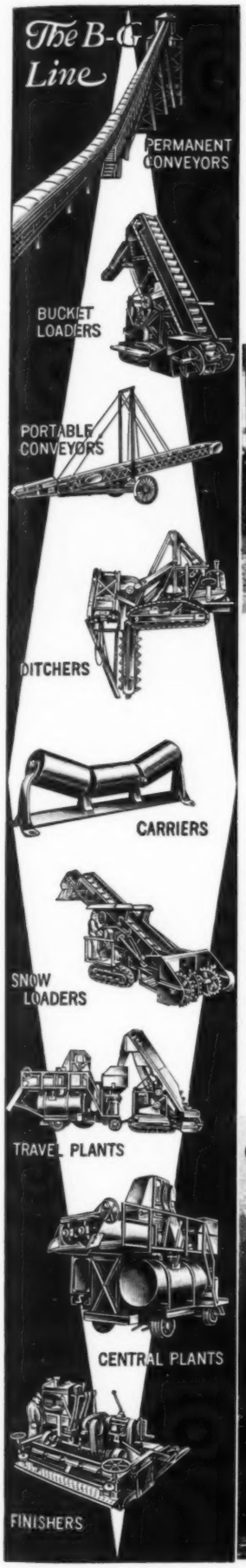
If for any reason it becomes necessary or desirable to leave the pavement, SLOW DOWN and then select a part of the shoulder that is hard enough to support the weight of the vehicle before venturing off the roadway.

Motorists who inadvertently drive off the pavement at high speed should IMMEDIATELY SLOW DOWN BEFORE ATTEMPTING TO DRIVE BACK ONTO THE PAVEMENT. Unless the speed of the vehicle is reduced to approximately 10 or 12 miles per hour, when the wheels do climb back onto the pavement, the vehicle is likely to continue on across the roadway into the path of oncoming traffic before the driver can again regain control, resulting in a head-on crash.

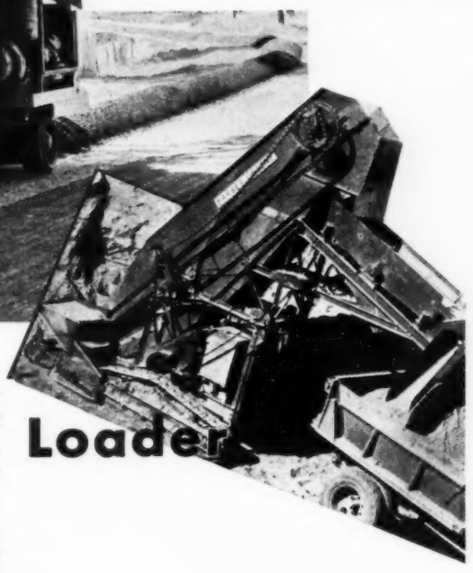
ARRIVE SAFELY!

¶ Following is an analysis concerning city street mileage and population made by the National Highway Users' Conference:

Cities having a Population of	Number of Cities	Population	Street mileage
100,000 and over	93	36,325,736	65,870
50,000 to 100,000	98	6,491,448	16,610
30,000 to 50,000	121	4,733,354	13,160
5,000 to 30,000	1,521	16,686,695	75,400
2,500 to 5,000	1,332	4,717,590	21,050
Total	3,165	68,954,823	192,090



Barber-Greenes for Higher Quality at Lower Costs



The Barber-Greene Travel Plant gives accurate proportioning and thorough mixing at road mix costs. Where conditions or specifications call for Central Plant operation, the Mixer Unit is detached and set up as shown below. Wheel mounted portability and set-up simplicity make it practical to set up at the best location for each job. The B-G continuous mixing principle gives remarkably high capacity per pound of machine. In addition to the flexibility of Travel or Central Plan operation, the B-G Loader can be used alone for innumerable profitable jobs: Loading from stock piles, stripping, pit excavation, light grading, backfilling, etc.

It will pay you to investigate these Barber-Greenes that give More Quality at Less Cost.

If you have not received your copy of "Good Roads" the new 52 page booklet that shows Barber-Greenes complete line for contractor's equipment, write today. There is no obligation.

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BARBER GREENE

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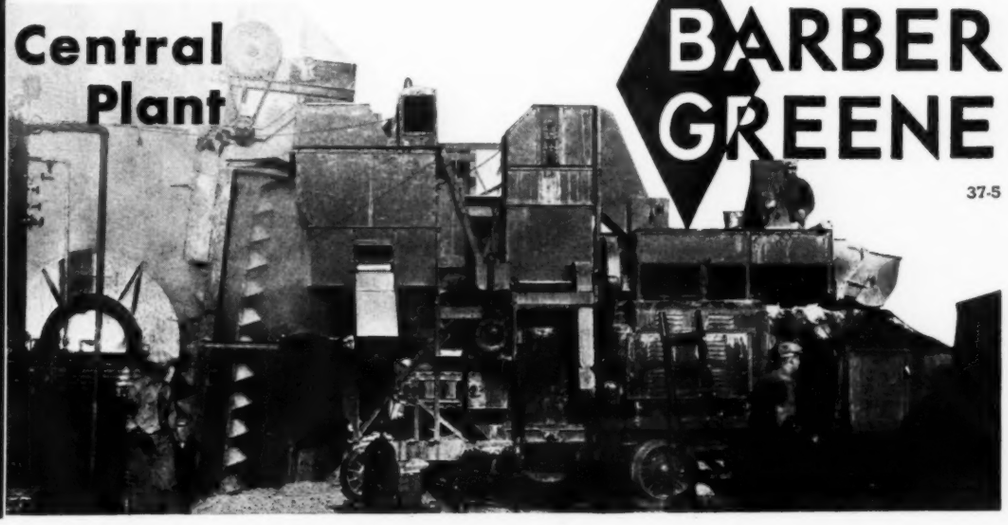

EDITORIAL

Capital-Labor Relationship Policy

SUCCESSFUL business enterprises, manufacturing, mercantile, or publishing, as a few, are guided by definite business policies. Why should not our general economic relationships be guided, also, by definite policies? The wave of sit-down strikes now scourging the country is quite indicative of the fact that an American Capital-Labor economic policy does not exist.

Throughout our mechanized growth, we have learned a few truths that point the way to a common meeting ground upon which to erect capital-labor relationship policies. We can all agree, I believe, that capital alone, is impotent. Likewise, labor alone cannot produce material wealth. The two must work together. It will also be conceded, I believe, that Americans do not wish to lower our standard of living, rather we desire further to improve upon it.

The laboring man wants to live comfortably and be able to educate his children. We agree that his economic status should be such as to permit him to do this. The American workman, generally, does not want strikes. He reverts to that recourse of Force because there has been no policy of Reason by which to present and settle his complaints.

The American business owner or capital employer hopes and strives for a happy, contented staff of workmen. At the same time he must make a profit to exist Competition limits the cost of his commodity and therefore establishes working conditions and workmen's pay to a large extent. If his competitors are governed by the same labor policy as he is, the tables are even and the workman's standard of living can be raised.

We agree, I believe, that Reason should supplant Force in the settlement of disputes. There was a time when disputes were recognized as affairs between the disputants only. That time is gone. We must now recognize that a Public interest exists, also. There is a Public interest in every business in which Labor and Capital, cooperatively, produce wealth. Time was when labor was considered a commodity, to be bought in the open market. We have come to realize that labor is also People, human beings. Therefore, it no longer can be considered as a commodity or, raw material, out of which, in combination with natural resource raw material wealth is created.

State and Federal courts have established the right of collective bargaining for labor. That right being established there is no reason why labor organizations cannot elect whomever they choose to represent them in councils or meetings. This right, however, does not mean that a few can bargain exclusively for all. It means the representative can speak only for those who elected him as spokesman.

Employers must also concede that labor has a Right to strike in order to compel negotiation on disputed questions. While employers must make some concessions, labor also must make certain concessions in order to reduce all problems to a common denominator.

Labor must recognize that employers must pay a fair price for capital they hire to keep the enterprise operating. Management of industry must also pay a reasonable wage to labor while at the same time keeping the cost of industrial products within competitive range. If exorbitant demands of pay are made on employers, and employers are unable to pay a reasonable return on hired capital, labor will disappear.

In this cooperative arrangement we must not lose sight of the third party, the Public or the Buyer. If prices for a commodity rise too high, a Buyers' Strike results and another depression is in the making.

The solution to the problem seems to be to make labor organizations into corporate beings with financial stability so they can enter into contracts with employers, and sue or be sued in the courts for violation of contracts. With definite wage and working condition contracts in force, employers can calculate labor costs accurately, establish fair commodity prices, and manage so as to show a profit. Out of profit, borrowed or hired capital costs can be paid to insure continuance of the enterprise and security of employment for labor.

Labor must concede to organizing an official body which determines Facts in a case before a strike is called and have the facts submitted to arbitration of Reason before employing the Force of a strike.

▼

She Knows!

WHY do men usually have to be disciplined before they fully realize that they must play the game according to the rules in order to receive its benefits? Take a military unit, for instance. If a soldier, or officer, violates the rules or regulations of the unit, disciplining action follows. It seems that he must be disciplined before he understands that the rules must be followed.

Maryland can be likened to the soldier, as regards participation in the benefits of Federal aid for highway work. She knows that she is diverting gas tax and motor vehicle license revenues to other purposes than for highway work. She knows that this is a violation of the law making Federal aid available. She knows that she can be disciplined by being penalized up to one-third of the allotment. Authority for the action taken by the U. S. Bureau of Public Roads is lodged in Sec. 12 of the Hayden-Cartwright Road Act of 1934. She knows that her highway system is obsolete and inadequate. She knows that she can save many lives of the citizens of her state, as well as those of other states, to say nothing of the savings she can make possible for motorists from property damage by improving and rebuilding her highways where needed. She knows that Governor Nice dropped the problem into the laps of the legislators. She knows that her people need a modern highway transportation system for their own economic welfare. She knows that she pays her share of taxes to the Federal government, out of which Federal aid appropriations and allotments are made. She knows that when the penalty is exacted

NOTICE!

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This new arrangement makes improved manufacturing facilities possible, assuring better workmanship and a better product.

It enables us to offer a superior trailer at lower costs.

The central location of Chicago provides for lower freight rates and prompt delivery.

If you are in the market for a heavy duty machinery trailer, it will be to your advantage to investigate the improved features that these trailers offer.

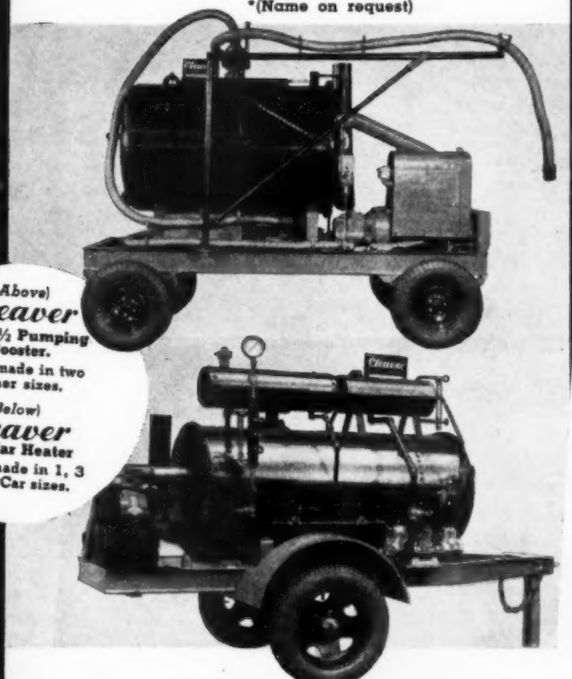
C. R. JAHN COMPANY
BUILDERS BUILDING
CHICAGO, ILLINOIS

"CHEAPER-MORE SATISFACTORY"

*says well-known contractor**

"We have found our No. 2 Cleaver Booster much cheaper and more satisfactory to operate than any type of heating equipment that we have used in our experience in the road business. We can heat 40,000 gallons in eight hours and have never had to hold up a job for want of hot oil."

*(Name on request)



(Above) **Cleaver** No. 1½ Pumping Booster. Also made in two other sizes.

(Below) **Cleaver** Two-Car Heater Also made in 1, 3 and 4 Car sizes.

MONEY-SAVING FEATURES CONCEIVED AND OFFERED BY CLEAVER

- Quicker steaming—30 minutes from cold water start. Saves idle time.
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Name .....

Address .....

City ..... State .....

she will not be getting her fair share of Federal aid as stipulated by the rules.

But—she has to be disciplined like a lazy or indifferent soldier before she attempts to abide by the rules. Why? And Maryland has plenty of company.

▼

High Speed Express Highways

ENGINEERS have been theorizing on the design of dual lane, high speed, express highways. Suggestions as to what governing factors should control the design have been published. Safety of the highway, i. e., safe use and safe capacity, has been the underlying principle upon which these discussions have arisen.

Considering purely Utopian conditions, impossible to attain, the suggestions published point the way to acceptable standards. Unfortunately, the administrative highway engineer of today is faced with the problem of economics. He must so administer his funds as to get the most out of them in highway construction. It has been entirely impossible to approach the design standards suggested for modern express highways, so far as highway construction with public funds is concerned. He certainly cannot be criticized for failing to measure up to the suggested standards. If "inadequate design from the standpoint of safety is unprofessional" and if the suggested standards as have been published are to be considered fundamentals of adequate design, then only two deductions are possible:

1. Either practicing administrative highway engineers are unprofessional, or
2. Highways should not, necessarily, be designed from the standpoint of safety.

Of course, what really occurs, is that as much safety is designed into a highway as funds will permit.

All of the above discussion refers to highway construction as it is financed at the present time. Should there be a possibility that private funds could be used for constructing an express highway as a commercial venture, then the proposed high speed standards might well be followed, justifiably. Only an exhaustive analysis and study of the economics involved and possible revenues to be derived from tolls and concession fees would indicate whether such a private venture might be profitable.

▼

Effect of Strikes

ROAD construction contractors because of two limiting conditions in contract work are particularly susceptible to damage from strikes. Already strikes in manufacturing industries supplying construction equipment manufacturers with parts are causing increased costs and equipment price raises. These higher equipment costs are bound to be reflected in higher prices per unit of road work.

The time limit clause in road and street contracts requires a job to be completed upon a certain date. Thereafter if not complete, a certain amount per day is charged against the contractor for each day behind completion date. Indirectly, strikes are now causing delays. Think what losses might be incurred if strikes were executed directly on a construction job. No matter whether the strike was a "sit-down" or "walk-out," the loss would be there. It behooves contractors, therefore, to anticipate this possibility and insure against possible loss by bidding a job at a little higher figure. It is believed that we can expect the construction industry to be subjected to labor organization. With prices of commodities rising we can expect strikes on jobs after they get well started.

It would not be difficult for a paving crew to suddenly stop work and picket a job. Workers to replace strikers would fear to go onto a paving job, stretched out as it is, in the country, over several miles. An army of deputized sheriffs would be required to protect men desiring to work.

Highway contractors usually work fairly close to their maximum capital limitations. A strike might readily mean bankruptcy for them. Unlike many corporations in which strikes are now or have been extant, a contractor is an individual entrepreneur, usually. His capital is tied up in materials and equipment. Unless he gets estimates, regularly, he cannot carry on.

The other limitation is the season. A prolonged, unsettled strike on, say, a highway grading job, would require the job to be carried over to the next working season. Penalties for lack of completion on completion date could be unbearable. The chances are that the bonding company would have to finish the job.

To protect themselves against this possibility contractors should put an "insurance against strikes" cost in their bids.

Naturally, these added costs mean higher prices per unit of road and street work. It is believed that this will come as sure as the sun will rise.

▼

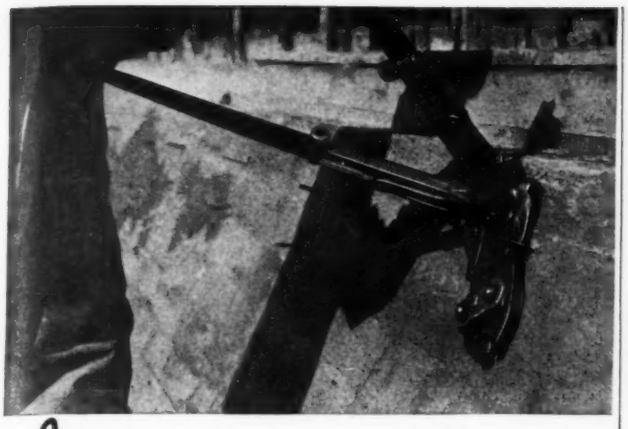
National Highway System

SOONER or later a National Highway System will be adopted by the Federal Government. The bill now in the House of Representatives, H.R. 4198, may not be the one but it points the way toward a goal at which we will one day arrive. The bill, introduced by Mr. Snyder of Pennsylvania and which was referred to the Committee on Roads, read in part as follows:

"A Bill to provide for the location survey, and building of a system of three transcontinental and six north-south highways. . . . That the whole of the United States may have as near as possible equal facilities for transportation of commodities, and to economize in the building of national highways and provide modern and adequate national-defense equipment, the Department of the Interior is hereby authorized and directed to locate, survey, and build (a) three transcontinental highways . . .; (b) six north-south highways, . . ., and (c) a system of airports in connection with such highways, one such airport to be located at each of the intersections of such highways one with the other. . . ."

The proposed bill continues by giving approximate locations of the highways. Two hundred foot rights-of-way are required. The bill sets up a fund of $12,000,000,000 to carry out its provisions. It requires construction to be completed by 1960 and work to be done by contract.

This bill does not follow the ideas, exactly, as proposed by ROADS AND STREETS because it does not take into account the recreational value of such a system if that system would tie into national parks and shrines. We believe the bill should not be reported out of committee but that another of similar nature should be enacted which gives cognizance to the social and recreational value of a system of National Highways.



for CUTTING METAL
out "On the Job"

PORTER
BOLT CLIPPERS

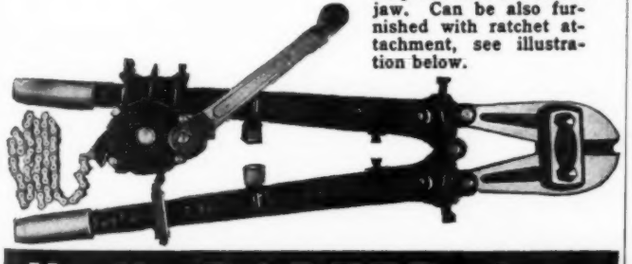
WHEN you're concreting a stretch of highway — pouring floors on a building job — putting in a dam or a heavy foundation — you need PORTER BOLT CLIPPERS.

They will save you time and money in cutting reinforcing fabric or rods—trimming off tie-wires after removal of forms—cutting bolts or chain—splitting nuts—cutting wire rope. One or more PORTER TOOLS will "earn their keep" on any contracting job.

Shown here is the PORTER SWIVEL HEAD CUTTER—the "wrist-action" tool that reaches over, under or around obstructions. Head swings 90° to either side, and cuts with full power in any position. Also made in rigid type, for a variety of special uses.

Ask your supply house; or tell us your requirements and let us recommend a Porter tool for the job.

For concrete rods and similar heavy jobs we can furnish a new heavy duty tool with center cut jaw. Can be also furnished with ratchet attachment, see illustration below.



H. K. PORTER, Inc.
EVERETT, MASS.

"Take our 40-mile Claremont job last summer. We expected to run into hard luck on the time element, and allowed for it just like the outfits who bid against us. Of course, *we* figured on our Heltzel Forms. Well... they ironed out all the trouble. We just set 'em with a couple of licks, yanked 'em up and set 'em again—ran our heaviest road machinery on 'em and treated 'em mean all around. We *moved*—finished up 65 days ahead of schedule. And those Heltzel Forms are good as new!"

Let us send you our Road Form Bulletin, No. 101. It points the way to *better work at lower cost*. Write for it today.

THE HELTZEL STEEL FORM & IRON CO
WARREN, OHIO

NEW EQUIPMENT AND MATERIALS

New Tar and Asphalt Heating Kettle

A new style tar and asphalt heating kettle has just been added to the Littleford line. Built along lines similar to the Littleford No. 84-HD model, this new heater has "double heat circulation" and a "screened reservoir."

Rated at 300 gals., the unit is stated to have an actual capacity of 350 gals. It

New Littleford Heating Kettle

has been engineered to avoid all unnecessary weight (actual weight on pnuematic tires, 2,250 lbs.). No sacrifice in strength has resulted from the design.

Here are general specifications:

Rated capacity	300 gals.
Overall dimensions	135 in. by 70 in.
Loading height above ground	59 in.
Springs, semi-elliptic	12-leaf
Roller bearings	Timken
Tires—pneumatics	32x6-10 ply single
Weight—on pneumatics	2,250 lbs.

Full information on this new heating kettle can be had by writing Littleford Bros., 454 E. Pearl St., Cincinnati, O.

▼

New Four-Wheel Scraper

The Bucyrus-Erie Co., South Milwaukee, Wis., has announced a new four-wheel scraper for the excavating field.

Using a three-point suspension, and with ample clearance to swivel the front wheels under the frame, this scraper can be maneuvered in short, sharp turns, making a complete circle within the radius of its own length. Because all four wheels are inside the path of the cutting edge, it digs full width in close quarters, and cuts right up against the bank or other obstructions. The dumping action is simple, fast, and positive. The bowl backs away and tilts forward sharply, while the apron tips and slides ahead—both to an almost perpendicular position.

A "double-curve" cutting edge is constructed to deliver a combined shearing cut and scooping action. In spreading, the scraper blade is used to level off the dump. It is stated that even when the scraper is working in wet ground, damp clay, or heavy gumbo, the loading, dumping, and spreading is performed easily and cleanly.

Of simple, strong construction, the box-welded frame which carries the unit resists both tortional and tensile stresses set up in scraper operation. Welded plates of high-tensile strength, alloy steel, form the bowl and apron. The replaceable cutting edge of high-carbon manganese steel is supported on a rigid, heat-treated, steel casting, welded into the bowl.

The scraper is regulated by an easy-running, single cable operating over a minimum number of sheaves from the drum power unit on the tractor. One control lever, conveniently placed, gives the operator instant and positive control of his loading, hauling, dumping, and spreading operations. An extra long cable is supplied, with the surplus footage coiled at the rear of the scraper. In case of wear or breakage, the amount needed for replacement is easily fed into the hoist from this coil.

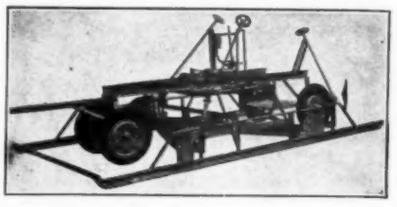
The Bucyrus-Erie 4-wheel scraper is manufactured in two sizes, 4½-yd. capacity and 7-yd. capacity level measure. A detailed and well illustrated bulletin is available upon request. Write to the Bucyrus-Erie Compnay, South Milwaukee, Wis.

Bucyrus-Erie 4-Wheel Scraper

New Road Shaper

A new addition to the line of "Original" road shapers built by the Gledhill Road Machinery Co. of Galion, O., is a road shaper in 10-ft. working width.

Heretofore the Gledhill road shaper, while made in two different weights—one known as the regular and the other as the heavy type—was made in only one width, one of 7-ft. working width. The proven excellence of this shaper led to a demand for the same high type efficient machine in 10-ft. width for working a 20-ft. road in one round trip and for use on blacktop and road stabilization. It was to meet this demand that the 10-ft. shaper



Gledhill Road Shaper in 10-Ft. Working Width

was developed, and it is now being offered to the trade for the first time.

The 10-ft. Gledhill road shaper retains all of the good features of the 7-ft. shaper. These include the straight edges, blade arrangement, hydraulic lift, easy low cost operation, weight control, and aprons, and in addition there is the difference in working width—a proportionate difference in weight, and the necessary increases in weight and size of some of the parts to meet added strains, and to keep the entire machine balanced and proportioned for the new working width and weight. The 10-ft. shaper will shape a 20-ft. road with one round trip and by the use of an adjustable apron attachment it will also do one round trip work on narrower roads such as 16 and 18 ft.

As with the 7-ft. sizes, the new 10-ft. shaper's weight is easily raised onto the pneumatic tired wheels for transportation. For long distance hauls the shaper is so made that the total width of the assembly can be reduced to 7 ft. by a simple dismounting and rearranging of some of the parts, when it can be drawn behind an automobile or truck.

▼

New Excavators

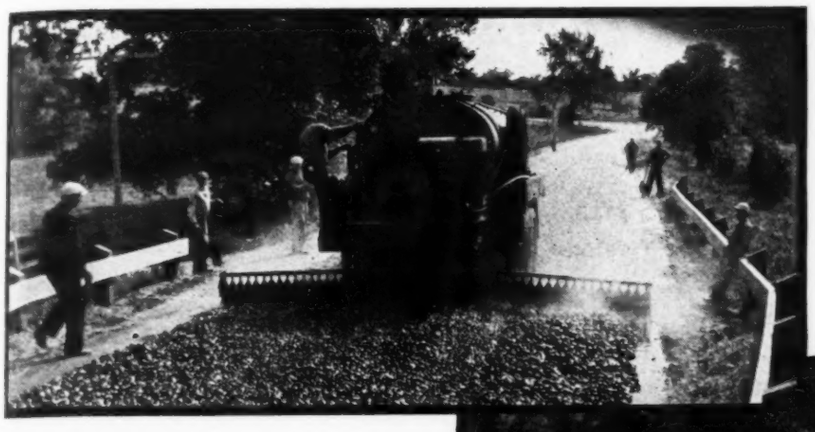
The Buckeye Traction Ditcher Co., of Findlay, O., manufacturers of the well known and complete line of Buckeye ditchers for over 35 years, have placed on the market a line of ½, ⅝ and ¾ yd. excavators, with shovel, crane, dragline, clamshell and trench hoe attachments. The new machines are known as Buckeye Clippers, Models 50, 60 and 70.

Modern engineering and materials—100 per cent electric alloy steels, anti-friction bearings, heat treated shafting, etc., used throughout—have produced a machine stripped of all excess weight and designed for modern, fast, efficient, safe operation.

Characteristic of the modern engineering found throughout the machine is the use of a tubular dipper stick, combining strength

THE EXTRA ADVANTAGES

of the NEW LITTLEFORD MODEL "C" DISTRIBUTOR



Instant Cut-off
without dribbling

Faster Heating
with Low-Pressure Burner—Continuous Heat Flue

Single Valve Control
with its "suck-back" feature

THE SINGLE VALVE on the Littleford Model "C" Pressure Distributor cuts off sprays instantly—without dribbling. By flipping the control handwheel over, one quarter turn, the suction of the pump sucks back into the tank all material in the lines and spray bar. A neat cut-off—without using a valve on every nozzle.

The Solution of Modern Maintenance Problems . . .

The Littleford No. 101 Sprayer

This big, fast heating, motor driven pump type bituminous road maintenance outfit will handle any type of material and do all your patching, shoulder maintenance and a lot of minor construction work. Ask for latest prices and data.

Emulsion and Cut-Back Sprayers

A complete line of small Littleford sprayers that operate with compressed air in one or two drum sizes with or without heating provisions is made. Use one of these handy, efficient sprayers for your penetration patching, concrete curing or paint coating for asphaltic repairs. Write, today, for information.

LITTLEFORD
Road Maintenance Equipment
SINCE 1900

LITTLEFORD BROS. 500 E. PEARL ST. CINCINNATI, O.

WHY I BOUGHT AN "ETNYRE"

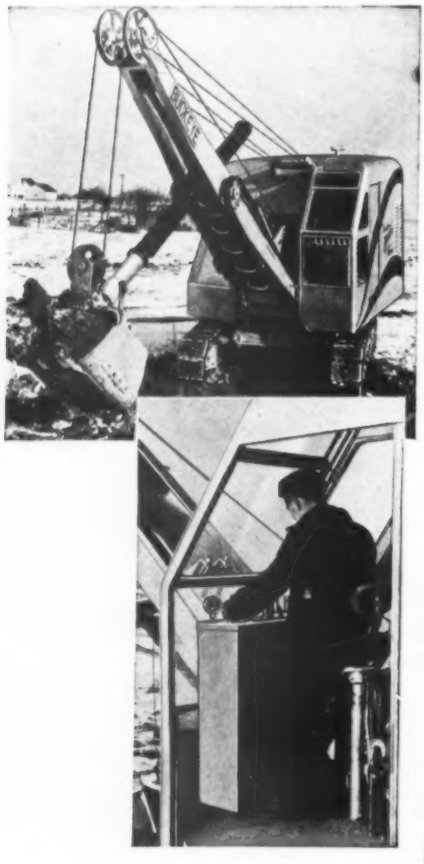
After Investigating All BITUMINOUS DISTRIBUTORS

"I have compared and tested all Bituminous Distributors. . . . I am convinced that no other equals the 'Etnyre' for *accuracy* of distribution, *simplicity and economy* of operation and dependable, *long-life service*. I find there are more Etnyres in use than any other type of distributor . . . and for good reasons. The Etnyre 'Instantaneous Shut-Off Spray-Bar' which eliminates 'dripping and slobbering' is the greatest improvement ever made in distributors. Etnyre 'Full-width-distribution' spraying up to 24 ft. road-width in *one* trip prevents over-laps . . . cuts operating time in half . . . and handles asphalt, tar, road oil or emulsion, either light or heavy applications for every type of bituminous road requirement. The Etnyre more than meets all Highway Dept. specifications. I am convinced the Etnyre will prove one of the soundest investments I have ever made."

NEW CATALOG tells all about the new Etnyre "FC and FX" Distributors. Ask for No. 506.

E. D. ETNYRE & CO.

OREGON **ILLINOIS**



Buckeye Model 50 Clipper

and flexibility with moderate weight. The streamlined cab of the new Clipper reflects this modern engineering.

One of the new departures in design found exclusively in Buckeye Clippers is the perfected system of control by metered vacuum. All operations are controlled from a simple control panel where small levers move easily at the touch of the operator's fingers.

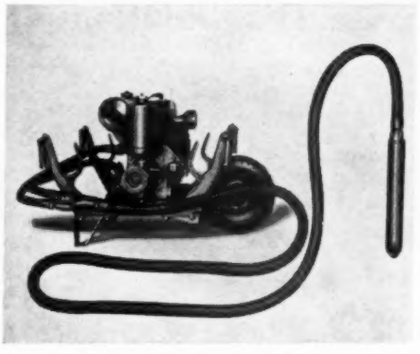
Developed and perfected for specific use on the Buckeye Clipper, this metered vacuum control is the standard product of a responsible automotive equipment manufacturer with national service facilities. Among other advantages of this vacuum type of control system is its complete freedom from trouble due to extremes of temperature, small leaks, or water in the lines. Automatic vacuum controlled brakes add considerably to the efficiency of operation.

Other evidence of consideration for the comfort of the operator is found in the exceptionally comfortable air cushioned seat, convenient rack for tools, and handy compartments for order book, personal articles, etc. The modern streamlined cab is heated in cold weather by a hot water heater, supplied as standard equipment.

▼

New Hydraulic Concrete Vibrator

A hydraulic vibrator has been placed on the market by the Electric Tamping & Equipment Co., Ludington, Mich. It consists of a vibrating element driven by a compact, powerful hydraulic turbine which is in turn driven by continuously circulating light bodied lubricating oil, the necessary pressure being supplied by a small geared pump. The pump is direct connected to a 3-hp. air-cooled engine.



Jackson Hydraulic Vibrator

Aside from the motor the vibrator case contains merely the vibrating element and its bearings. This element is so designed and constructed that it is operated at very high speeds and together with its ball bearings is completely submerged in oil which is continuously circulating at the rate of 20 gal. per minute.

All variations in pressure and load react directly on the engine governor and no additional governing device is required. The frequency of the vibrator is always in direct ratio with the engine speed and, regardless of whether the spade is running free or fully loaded, the frequency will be as constant in percentage of range as the governed engine.

Special hose equipment has been devel-

FOR EVEN, REGULATED SPREADING...

The Good Roads N&H Mechanical Spreader is unbeatable for even, accurately regulated material spreading. A spiral agitator bar, driven by a floating drive wheel, assures a constant flow of material through adjustable openings. Spreading width 6 inches to 9 feet. All-steel construction. Can be attached or detached in less than a minute. For full information, write for our Good Roads N&H Mechanical Spreader Bulletin No. 5362.

GOOD ROADS
MACHINERY CORP.
KENNETT SQUARE, PA.

oped for this particular service. The lining is of oil-proof synthetic material and the covering is of the best tire tread rubber. For a greater portion of the line the pressure feed hose is operating inside the flexible handle hose which is also the vacuum return line.

The hydraulic power unit complete with pneumatic wheel weighs 200 lb. It is 27 in. high, 42 in. long and 24 in. wide.

▼

New Hauling Scrapers

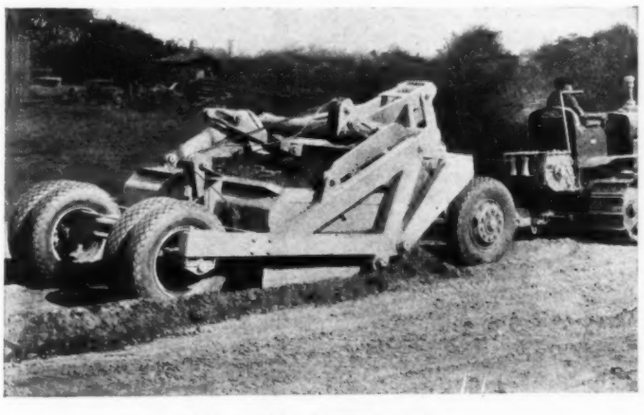
J. D. Adams Co., Indianapolis, Ind., recently added a new piece of earth-moving equipment to their line of the road building and maintenance machinery. This new unit is known as Adams hauling scraper and is being manufactured in 5, 6, 8, 10 and 12 yd. sizes.

This new scraper is of all-welded, heavy steel plate construction with a well-braced box-type drawbar. It is operated by cables from a one or two drum power control unit which is mounted on the tractor and takes its power from the power takeoff shaft on the tractor. These power control units are available for any make of tractor.

According to the manufacturer, careful engineering has provided the correct angle to the cutting blade which feeds the dirt into the bowl. The depth of cut is adjustable from the tractor operator's seat. After the scraper has been loaded the bowl is lifted into hauling position and an apron on the front of the scraper is closed with a clam-like action. When the scraper is in hauling position its entire weight is supported on six large tires and roller bearing wheels, which cause the scraper to roll to the dump with the least amount of drawbar pull. By power control the apron is raised and the load is dumped while the scraper is either traveling or stopped.

Power required to pull these scrapers ranges from 35-40 HP. for the 5-yd. size to 80-90 HP. for the 12-yd. size.

Descriptive literature may be obtained by writing the manufacturer.



Adams New Hauling Scraper

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New Line of International Trucks

A complete new line of International motor trucks consisting of 26 models, 77 wheelbases, and sizes ranging from the ½-ton to the big 10 to 15-ton six wheeler, has just been developed by the International Harvester Co., 606 South Michigan Ave., Chicago, Ill. This is the first time that the International motor truck line has been so completely changed at one time. Not only have many engineering improvements been incorporated in the design of these new motor trucks to make them sturdier and more economical to operate, but much thought has also been devoted to streamlined styling.

These new Internationals provide universally standardized (S.A.E.) cab-to-rear-axle dimensions. Front axles are set back, and this, together with the relocation of rear axles and cabs, contributes to greatly improved load distribution, not only of body and payload but of gross weight as well.

Wheelbases, in conjunction with correct cab-to-rear-axle dimensions, are available to

An Investment in Safety

The new Barricade Type Martindale Safety Signal meets the demand for a sturdy signal that the wind will not blow over and that motorists cannot fail to see. No judge or jury can charge you with negligence when you use Martindale Safety Signals. They not only protect lives and property but they protect you from damage suits. Martindale Safety Signals are not an expense—they are an investment that pays you handsome profits. When you compare your accidents before and after using Martindale Safety Signals, you wouldn't sell them for ten times their cost. Write for 4-page bulletin giving complete description and prices.

THE MARTINDALE ELECTRIC CO.
1349 Hird Ave. Cleveland, Ohio

DIG *faster* with a WILLIAMS

Shorter cable overhaul for great speed.

Exclusive power-arm combination of lever and block-and-tackle for greater digging power.

Get the details. *Write for new bulletin.*

The "Champion" Power-Arm Bucket

THE WELLMAN ENGINEERING CO.
7020 Central Avenue, Cleveland, Ohio

WILLIAMS
POWER-ARM, POWER-WHEEL, MULTIPLE-ROPE, DRAGLINE ..... *buckets*

accommodate all lengths of bodies, with the ideal conditions resulting from the use of bodies in even foot lengths. At the same time, bodies in odd foot lengths will permit satisfactory mounting and load distribution on either the next shorter or longer wheelbase.

Many decided improvements and new features of design and construction have been incorporated in the engines of the International models. While greater power has been provided for each of the new models, there has been no sacrifice in the fuel economy. Performance, climbing ability, pulling power and operating economy are decidedly improved.

All International truck engines are designed and built for truck service. They are heavy-duty power plants that deliver maximum performance at low cost. The types FA and FB valve-in-head engines which power the 2-ton and larger Internationals have replaceable cylinders; counterbalanced vibration-dampened crankshafts; full-pressure lubrication; precision-type, replaceable-shell, main and connecting-rod bearings; hardened exhaust-valve seat inserts; downdraft carburetion; scientifically designed manifolds; oil-bath air cleaners; air-cooled generators; and other outstanding features which provide maximum power, unexcelled performance, long life and economy.

International DR-60 Chassis, Rated at 4 to 5 Tons

The HD type "L"-head engines which power the ½-ton and ¾-ton models have a displacement of 213 in. and the engine in the 1 and 1½-ton models has a displacement of 232 inches.

In addition to improved appearance, standardization of body lengths, easier handling and greater power, many new and important features are incorporated in each of the new Internationals. All models have deeper, heavier frames and even more efficient breaking systems than in the past. Front spring-pad capacities have been proportionately increased to provide for the greater proportion of the load now carried by the front axle. Clutch and transmission torque capacities have been increased to match the greater torque of the engines. Helical-gear transmissions, with direct fourth speed and fuel-saving overdrive in fifth, provided in the larger models, offer outstanding advantages, especially in long-distance hauling. This type of construction enables the operator to maintain high speed with reduced engine speed and with a consequent saving in fuel and oil and reduced engine wear.

Hydraulic brakes are standard equipment on all International models from the light delivery units to the 4 to 5 ton double-reduction drive Model DR-60.

Air Compressor *from* FORD PARTS

Model A or B Ford Motor fitted with patented Smith Compressor Head with two cylinders for power and two compressing air. Over 60 cubic feet per minute capacity. Head equipped with high speed compressor valves. Automatic unloading and idling. Widely used to operate jackhammers, paving breakers, clay spades, tampers, riveting hammers, sand blasts, paint sprays, etc.

Low first cost, light weight, economical operation, repair parts available everywhere.

Complete machines available or Smith Compressor Head and accessories with instructions for mounting.

Write for complete information and prices.

GORDON SMITH AND COMPANY, INC.
516—10th St., Bowling Green, Kentucky

SIMPLE RUGGED DEPENDABLE CONSTRUCTION EQUIPMENT — STERLING QUALITY

IMPROVED GREASE SEAL

Sterling pumps are equipped with an improved double grease seal entirely protected from grit and dirt, eliminating packing and packing troubles. Sterling pumps are made to pump dirty, muddy water and the grease seal effectively protects the shaft and eliminates air leaks.
Write today for Condensed Contractors' Equipment Catalog No. 37 and Price List No. 37.

Sterling MACHINERY CORPORATION
411-13 Southwest Blvd. Kansas City, Mo.

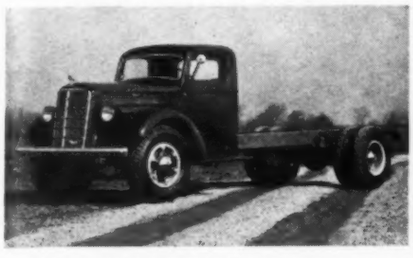
Two New Truck Models

Two new models, the EM rated at 20,000 lbs. gross, and the EQ 23,000 lbs. gross, have just gone into production, according to announcement from Mack Trucks, Inc., 34th St. and 48th Ave., Long Island City, N. Y. In the modern streamline styling of the two new models, Mack has carried out the same general design introduced last year on the EH, an 18,000 lb. gross model.

Models EM & EQ are offered in four standard wheelbase lengths from 146 in. to 194 ins. for the truck, three wheelbases from 141 ins. to 158 ins., on the tractor.

The Model EM is powered by a 6-cylinder engine with 3⅝ in. x 5 in. bore and stroke developing 79 h.p. at governed speed of 2,300 r.p.m. Total piston displacement is 310 cu. in. Model EQ has a 3⅞-in. x 5-in. powerplant generating 92 h.p. at governed speed of 2,300 r.p.m. with 354 cu. in. of piston displacement.

Among the outstanding features of both



Mack Model EQ Chassis, Rated at 23,000 Lb. Gross Vehicle Weight

engines are case-hardened fully counterbalanced crankshaft; exhaust valve seat inserts of Mack's exclusive Niferrite alloy; Mack Permafit exhaust valves of austenitic steel for prevention of distortion at high temperatures; radiused cylinder bores to prevent cracked cylinders between the bore and the valve deck; cold circulation type thermostatic temperature control to promote rapid warming of cylinders; offset turbulence combustion chambers which permit high compression without detonation; and case-hardened nickel steel timing gears with generator ground helical teeth.

The chassis frame on both models is of pressed carbon steel. It is 9 1/16 in. deep. 9/32-in. thick and has a 3¼-in flange. It is staunchly braced by three pressed steel. deep flanged box girder cross members, with alligator jaw attachment to the side members, and two channel cross members.

▼

Tractor Loaders

Front end attachments for wheeled type industrial tractors, known as Tracksons-Lessmann, heretofore produced by the Trackson Co. of Milwaukee, are now being made by the White Manufacturing Co. of Elkhart, Ind.

This transfer of manufacture and sales applies only to the apparatus for use on tractors equipped with wheels and pneumatic tires. The equipment mounted on crawler tractors will be continued in active production by the Trackson Co.

The appliances affected by this arrangement constitute a line of material handling attachments, including excavators, graders, backfillers, loaders and platform hoists. Several changes in design are embodied. These devices have been widely used over a period of several years, and hereafter they will be known as "White Front End Attachments."

Five models are being offered. Model R-10 is an excavator, grader and material mover, with ½-cu.-yd. bucket or shovel and 3-ft. lift. Model R-22 is a loader with ⅜-cu.-yd. bucket and 7-ft. lift to load standard motor trucks at the side or rear.

Model R-30 is a special high lifting machine, 8½- ft., and equipped with ⅝-cu.-yd. bucket, principally for handling snow, cinders and other light weight materials.

The backfiller or grader with 6-ft. by 20-in. moldboard is known as Model R-35. Its blade can be tilted or set at an angle to push material to either side as well as straight ahead. Model R-40 is equipped with a pronged fork and is suitable for farm use as well as industrial. Model R-45 is a platform hoist for vertical lifting of boxes, barrels and material stock for storage or loading. It has a platform 31 in. by 42 in. with capacity of 4,000 lbs. and lift of 6 ft.

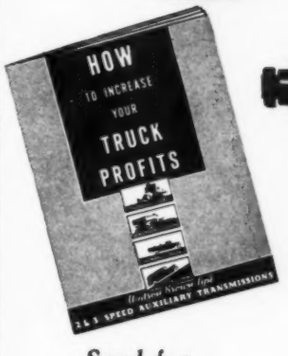
The White loaders are actuated by tractor engine through standard power take-off with multiple disc clutch and suitable con-

(*Continued on page* 110)

"You need more gears Buddy"

Don't BLAME YOUR TRUCK Simply FILL THE GAPS BETWEEN YOUR GEARS with WATSON-BROWN-LIPE

Your engine probably has all the power you need, but it can't perform with only 4 speeds as well as it could with more. Don't you find you could use different gear ratios to advantage every day, if you had them? Watson-Brown-Lipe Auxiliary Transmissions give them to you; one lower gear, one higher, and two more speeds between each regular gear. You can use your engine power to better advantage. You'll get more power, faster trips, lower gasoline bills, less oil consumption, reduced operating costs, less wear and tear, longer truck life, better performance, more earnings and more profit.



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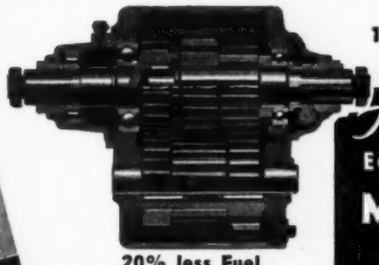


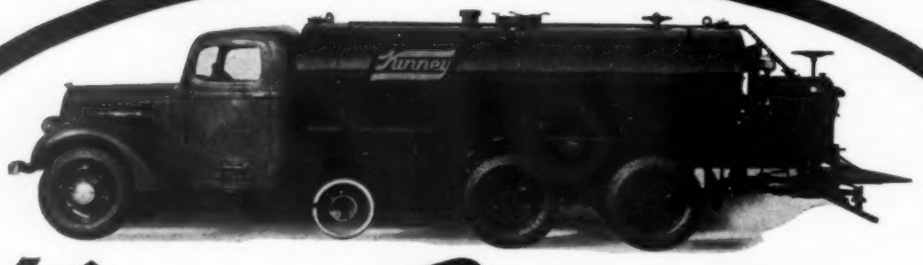
Gives 12 Speeds Forward 3 Reverse

20% less Fuel
23% fewer engine r.p.m's
52% more power

This PIECE OF EQUIPMENT WILL MAKE YOU MONEY

DISTRIBUTORS LOCATED IN ALL PRINCIPAL CITIES
H. S. WATSON CO.
1145 Harrison St., San Francisco. Eastern Branch: Box 385, Toledo

WATSON-BROWN-LIPE 2 and 3 SPEED
Auxiliary TRANSMISSIONS
"3 AXLE RATIOS ARE BETTER THAN 1"
MULTIPLIED TRUCK ECONOMY



Kinney Distributors

come *complete*, ready to go to work, no extras to buy

. . . apply more evenly and accurately . . . load, travel, unload faster . . . stay on the road more days per season . . . have a safer, better heating system. Heavy Duty; All-purpose, and General Service Models. Also 2 Junior Models for light trucks.

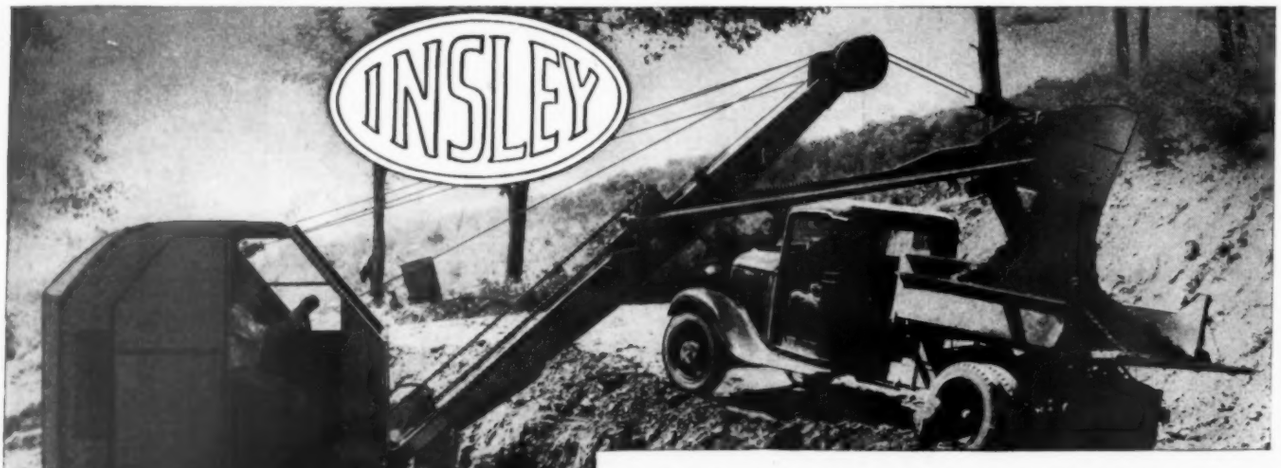
Write for Bulletin A.

Kinney Plain and Steam-Jacketed Pumps—Bulletin 14

KINNEY
MANUFACTURING CO.

3537 Washington St. Boston, Mass.

NEW YORK 30 Church Street
CHICAGO 1202 Buckingham Bldg.
DALLAS 808 Santa Fe Bldg.
PHILADELPHIA 725 Commercial Trust Bldg.
LOS ANGELES 1333 Santa Fe Avenue



RIGHTLY PRICED
SOUNDLY ENGINEERED
NATIONALLY SERVICED

● **Insley Type "K-10" shovel gives contractors the maximum in 3/8-cu. yd. shovel performance at a new low operating cost.**

Independent crawler control.
Crawler shoes of high carbon steel with high center-track design.
Full revolving frame, all welded construction, with hook-under rollers.
Roller type drive chain with self-cleaning sprockets.
Insley patented crowd.
Swinging speed . . . 5 r.p.m.
Interchangeable attachments . . . Shovel, Trench Hoe, Clamshell, Dragline.

Specify Insley Type "K-10" Excavator for time saving and extra profits.

INSLEY MANUFACTURING CORP., INDIANAPOLIS, IND.

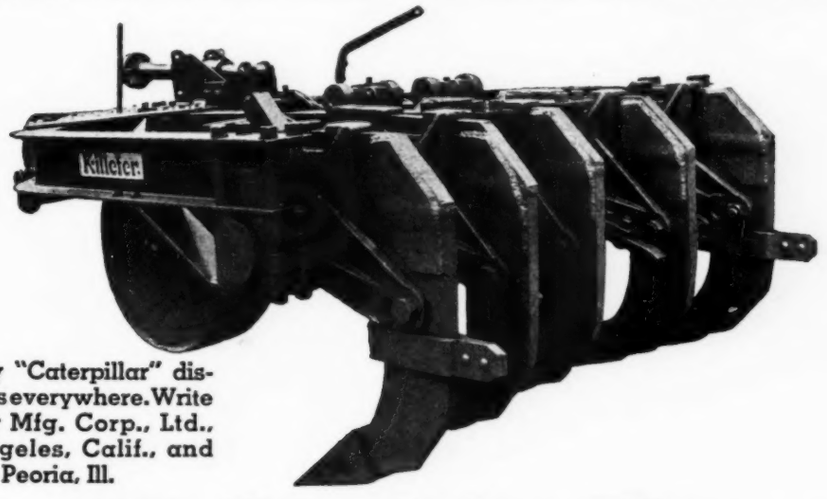
Killefer road equipment

- Revolving Scrapers
- Revolving Rippers
- Regular Rippers
- Road Discs, or Planers
- Compacting Harrows
- Oil-Mix Cultivators
- Ditchers
- Mole-Drain Machines

■

Write for Literature

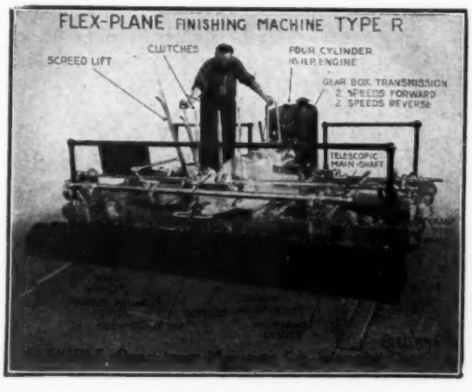
A REAL self-cleaning ripper. The toolhead rolls like a barrel to clear obstructions or stop digging. Great clearance under frame and between points (front to rear). Heat-treated standards and points. Working depth 14". Point spacing 18". One-rope control. Accurate depth adjustment. For tractors of 60 to 75 horsepower. Weight 7,580 lbs. Two smaller models. Write for folder R-64.



Sold by "Caterpillar" distributors everywhere. Write Killefer Mfg. Corp., Ltd., Los Angeles, Calif., and Peoria, Ill.

No. 170 Revolving Ripper

"SPEED EQUALS PROFIT"



Contractors use "FLEX-PLANE" equipment for installing dummy joints and surfacing concrete. "Dummy joints are the vertebrae of concrete roads."

"FLEX-PLANE" wide screed finishing machines screed while traveling backward. One machine builds roads 10 to 22 feet wide.

Secure this good equipment, speed up your work, then devote your time to other details.

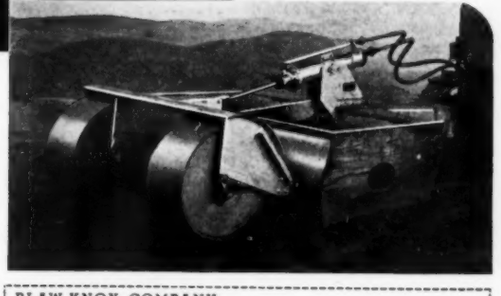
FLEXIBLE ROAD JOINT MACHINE CO.
WARREN, OHIO

--to make Dirt Moving Pay

BLAW-KNOX (ATECO) HYDRAULIC BOTTOMLESS SCRAPERS

The dependable performance of Blaw-Knox (Ateco) Hydraulic BOTTOMLESS SCRAPERS keeps dirt moving costs *down*—enables the contractor to operate his job on a definite schedule and at a profit.

It will pay you to investigate this BOTTOMLESS SCRAPER—also the Blaw-Knox (Ateco) Sheepsfoot TAMPING ROLLER.



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USE COUPON

BLAW-KNOX COMPANY
2003 Farmers Bank Bldg, Pittsburgh, Pa.

Please send:—CATALOG No. 1540—Blaw-Knox (Ateco) BOTTOMLESS SCRAPERS . . . ☐

Please send:—CATALOG No. 1550—Blaw-Knox (Ateco) Sheepsfoot TAMPING ROLLERS ☐

Individual_____

Company_____

Street_____

City_____ State_____

trols. Automatic stops are provided at the top of each lift as well as automatic brakes to hold buckets or platform at any height. By the use of the same mechanism in each model, there is considerable interchangeability of the machines for various duties, as well as for general drawbar use.

The equipment now in production is applicable to Fordson tractors. The full line will be adapted as rapidly as possible for other makes of industrial tractors.

▼

New Stabilizer for Dump Trailers

A new load stabilizer to be used on dump trailers has recently been developed by the Fruehauf Trailer Co., Detroit, Mich. The purpose of this mechanism is to maintain equal loads on each spring at all times.

The stabilizer is of primary value when a dump trailer is in dumping position on uneven ground. By transferring the load over a torsion rod running across the chassis and connecting the two springs, the stabilizer eliminates the sag. On level roads the stabilizer is simply a floating bar.

In addition to this primary value, the stabilizer is effective in eliminating body sway when dump trailers, which are high for their length, negotiate turns.

▼

New Series Industrial Engines

A new series of 4-cylinder industrial engines known as Series F400 has just been released to the trade by Continental Motors Corporation, Muskegon, Mich. There are three engines in the Series, 124, 140 and 163 cu. in. displacement, respectively.

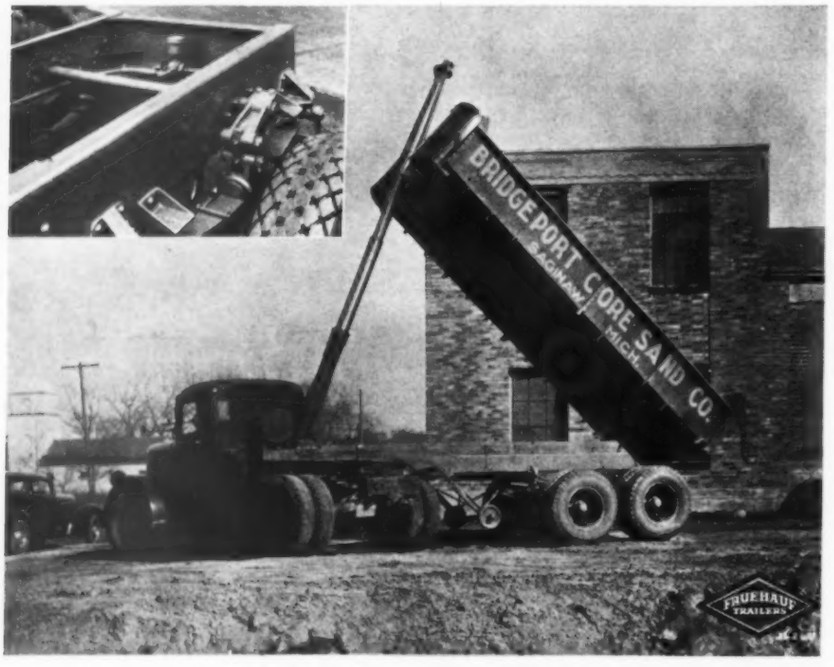
This series incorporates the exclusively patented feature of individual porting, which is claimed to make possible a perfectly balanced uniform flow of fuel, eliminating the starved or lazy cylinder.

The engines have full length water jackets with a front end pump which discharges in a gallery under the valve port, thus placing the coldest water directly where it is needed.

The crankshafts are of rugged design and weigh 35 lb. Crankshaft main bearings are 2¼ in. in diameter. The cylinder and crankcase are cast integral of copper chrome alloy iron. Exhaust valves are of austenitic KCR material.

Cylinder head is made of cast iron. The combustion chambers are designed to permit high compression ratios without sacrificing smoothness.

These units are furnished as open type power units with radiator and gas tank, or as complete power units with sheet metal housing and muffler. They are also available with heavy duty, industrial type, power take-off with or without clutch.



Sand and Gravel Tractor-Trailer of Bridgeport Core Sand Co. of Saginaw, Mich., Is a Sample of Dump Trailer which the New Load Stabilizer Will Particularly Benefit.

WITH THE MANUFACTURERS

Reid Appointed Operating Engineer of Universal Atlas

Appointment of H. P. Reid as operating engineer of the Universal Atlas Cement Co., U. S. Steel subsidiary, is announced by Paul C. Van Zandt, vice-president in charge of operations.

Mr. Reid formerly was special engineer and has been with the company 14 years. His entire experience has been connected with plant work and has dealt particularly with kiln operations and fuel economy. He is a graduate in mechanical engineering of Cornell University and is a member of the American Society of Mechanical Engineers and of the American Society of Heating and Ventilating Engineers.

He is author of "Studies of Fuel Economies in Burning Portland Cement," "Use of Fuel in the Manufacture of Portland Cement" and "Use Classification of Coal in the Portland Cement Industry."

▼

Abrams-Anderson Co. New Distributor for Bucyrus-Erie

The Bucyrus-Erie Co., South Milwaukee, Wis., announces a new shovel distributor, the Abrams-Anderson Co, 10425 Northlawn Ave., Detroit, Mich. Abrams-Anderson will represent Bucyrus-Erie throughout the southern peninsula of Michigan. They will carry an adequate stock of repair parts at their Detroit warehouse where they will also have on display the smaller sizes of the Bucyrus-Erie line of excavators.

▼

Boehck New Distributor for Lima Locomotive Works

Lima Locomotive Works, Incorporated, Shovel and Crane Division, Lima, O., announces the appointment of the Boehck Equipment Co., 2404 West Clybourn St., Milwaukee, Wis., as distributors of Lima excavators in Wisconsin. The personnel of the Boehck Equipment Co. has long been identified with the construction industry and their many years of experience with excavating machinery qualifies them to furnish full and complete information on Lima shovels, draglines and cranes.

▼

Ginsberg & Horan New Dealers for Bucyrus-Erie

The Bucyrus-Erie Co., South Milwaukee, Wis., has appointed the firm of Ginsberg & Horan, 355 Walton Ave., New York, N. Y., as new dealers for their line of excavating equipment. Ginsberg & Horan will serve the New York metropolitan area and will carry an adequate supply of repair parts at their New York warehouse where they will also have on display the smaller sizes of Bucyrus-Erie shovel equipment.

▼

Well-Known Dealers Added to Littleford Distributor Roster

The Hall-Perry Machinery Co., Butte, Mont., has just received appointment as exclusive Littleford agents in the State of Montana.

The Jeff Hunt Road Machinery Co., Columbia, S. C., recently obtained exclusive rights to the Littleford account for the State of South Carolina.

The Southern Iron & Equipment Co., Atlanta, Ga., have been appointed Littleford dealer in the State of Georgia.

▼

H. P. Mee Resigns from Caterpillar Tractor Co.

Extensive citrus interests in California which demanded more and more of his personal attention, have resulted in the resignation of H. P. Mee, vice-president of Caterpillar Tractor Co., effective June 1.

The press of executive work and administrative duties in connection with the

★ South Bend ★

Bituminous Material Distributor

Embodying 29 Years' Experience

ECONOMICAL EFFICIENT STURDY

ACCURATE APPLICATION—IMPROVED HEATING—QUICK SHUTOFF

NON-DRIP SPRAY BARS

★

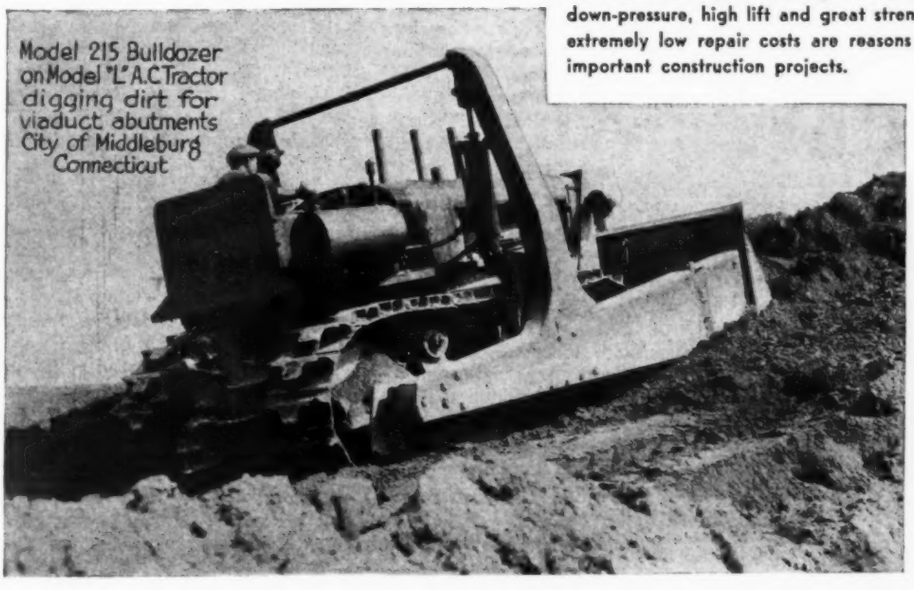
MUNICIPAL SUPPLY COMPANY

SOUTH BEND, INDIANA

BAKER

Better Bulldozer Performance

Until you experience the smooth and accurate performance of the simply-constructed, direct lift Baker Bulldozers and Gradebuilders, you will not know real economy in bulldozing operations. Tremendous down-pressure, high lift and great strength, together with long life and extremely low repair costs are reasons for the wide use of Bakers on important construction projects.



Ask for latest Bulldozer Bulletins

BAKER TRACTOR EQUIPMENT
BULLDOZERS
GRADEBUILDERS
ROAD ROOTERS
TRACTOR SCRAPERS
ROAD DISCS
MAINTAINERS
SNOW PLOWS

THE BAKER MFG. CO.
506 Stanford Avenue
Springfield, Illinois

DIRECT LIFT BULLDOZERS

supervision of all sales, service and advertising activities at "Caterpillar" has required Mr. Mee's continued presence at the Peoria, Ill., offices and plant. In the meantime, Mr. Mee's citrus holdings in Southern California have been expanded, resulting in his decision to transfer his activities there. He will probably make his home in Santa Barbara.

Mr. Mee joined the C. L. Best Tractor Co., predecessor of "Caterpillar," 17 years ago as credit manager. When Best and Holt companies merged, he became treasurer, then secretary-treasurer, and later vice-president and treasurer. 1934 saw him promoted to vice-president in charge of sales. Two years later he was advanced to his present administrative post.

▼

Ransome Adds New Agents

In order to take care of rapidly increasing business and offer better service to customers, Ransome Concrete Machinery Co., of Dunellen, N. J., announces the appointment of the following to handle its line of concrete mixing and handling equipment: Brown-Strauss Corp., 1402 Guinotte Ave., Kansas City, Mo.; Shovel Supply Co., 1302 McKinney Ave., Dallas, Tex.; Highway Equipment Co., 1359 Earnst St., Cincinnati, O.; Contractors Machinery & Supply Co., 200 East 11th St., Chattanooga, Tenn.; Dakota Tractor & Equipment Co., 301 N. P. Ave., Fargo, N. Dak.; H. B. Faith Equipment Co., 2724 Auburn St., Rockford, Ill.

▼

Kuttler Appointed Manager New Factory of Trailer Co.

The Trailer Company of America, Cincinnati, O., manufacturers of Trailmobile interchangeable and Lapeer automatic trailers, announces the appointment of Joseph Kuttler as manager of its new Pacific Coast factory to be established at Oakland, Calif.

Mr. Kuttler will be in charge of production and sales of the West Coast factory branch where the complete line of Trailmobile and Lapeer trailers and bodies will be manufactured.

▼

Universal Atlas Plants Awarded Safety Trophy

When the Hudson, N. Y., Universal, Pa., and Waco, Tex., plants of the Universal Atlas Cement Co., U. S. Steel subsidiary, were recently awarded trophies for operating throughout 1936 without a single disabling accident, it gave the entire company a 100 per cent representation, all its other plants having previously won the trophy from one to five times. The record was announced in a report by Gordon C. Huth, assistant manager, industrial relations department.

The coveted safety trophy given annually for the last thirteen years by the Portland Cement Association goes only to plants which operate a full calendar year without a lost-time accident. Since the awards were inaugurated the Universal Atlas Co. has won 24 trophies.

Timken Expands Research and Testing Facilities

New quarters and additional equipment, much of it unique, have expanded the research and testing facilities of the Timken Roller Bearing Co., Canton, O., to a point where it is probably the most completely equipped unit of its kind in the United States. Housed in a single story, well lighted brick building, 150 by 80 feet, the laboratory stands across the street from the main office and factory, convenient for personnel and easily accessible. Fig. 1 shows a general view of the main room in this new laboratory.

The far end of the building is occupied by a battery of eight machines designed to test bearings up to 8 in. OD to destruction under radial and thrust load.

Automobile rear axles and transmissions, together with the bearings used in them, are tested in a 75-100-hp. GE electric dynamometer together with two GE hydraulic dynamometers.

The laboratory contains a bearing testing machine which is thought to be the

General View of Main Room in New Laboratory

largest in the world. This was designed by Timken engineers to meet their special needs. In it single or double row bearings up to 24 in. OD can be tested to fatigue under both radial and thrust load. Radial loads up to 500,000 lb. and thrust loads up to 200,000 lb. may be applied to the bearings under test by means of hydraulic rams. Provision is made for filtering and cooling the lubricant. One pump circulates the oil through a cooler and delivers it to the housing, while a second pump draws the lubricant from the housing back to the oil tank beneath the machine. Provision is made for maintaining any desired oil level in the housing. A 75-hp. two-speed motor drives the bearings through a transmission capable of speed changes from 27 to 1,000 r.p.m.

Supplementing the 24-in. radial thrust machine is a 12-in. unit which has a capacity of 150,000 lb. radial and thrust load, measures torque through a cradle on which both the driving motor and transmission are mounted. The lubricant is circulated through a cooling system beneath the machine.

The laboratory also contains equipment for testing the deflections of automotive rear axles. The axle under test is driven by a 20-hp. motor through two automotive transmissions. A speed of 12 r.p.m. is used for driving the pinion of the test axle. Torque is absorbed by two prony brakes which can absorb 20,000 lb. feet, maximum input torque being 2,500 lb. feet.

Two profilographs are installed in an air-conditioned room in the new Timken laboratory. One unit is capable of 5000 X vertical magnification, while the other is used for amplifications up to 2000 X. This equipment was originally developed for the Timken company in the research laboratories of the University of Michigan and is used for checking surface finish.

To check the quietness of bearings a machine was developed which allows a bearing to be loaded with any pressure desired up to 1000 lb. This machine is run in a sound-proofed room for testing. The machine is capable of running at constant speeds or being accelerated or decelerated as desired.

Axle fatigue tests are made on a battery of machines which are capable of handling axles up to 2 in. in diameter. However, with the application of Timken bearings to locomotive driving axles operating at high speeds, it was thought desirable to secure basic data on full size specimens. This required the design and construction of an entirely new piece of equipment, the only one in existence. Two axle shafts 8 ft. long and up to 14 in. in diameter may be tested simultaneously in this machine, one being mounted at each end.

One of the largest and most complete set-ups for photoelastic research and testing in this country has been installed by the Timken company and much valuable data as to stresses and their distribution in various design members such as fillets, notches and other design shapes for which there is no analytical solution for the calculation of stresses have already been secured on this equipment.

Office, darkroom and drafting facilities as well as sufficient machine tool equipment are of course provided in this new laboratory, which is operated on a 24-hour basis, most tests being continued to destruction. Chemical and metallurgical facilities are available in the steel and tube division laboratories of this company, which are used to supplement and amplify the work done in the physical testing laboratory. Much of the machine work in preparing specimens is done in the bearing plant tool room or experimental department, thus saving laboratory time and floor space.

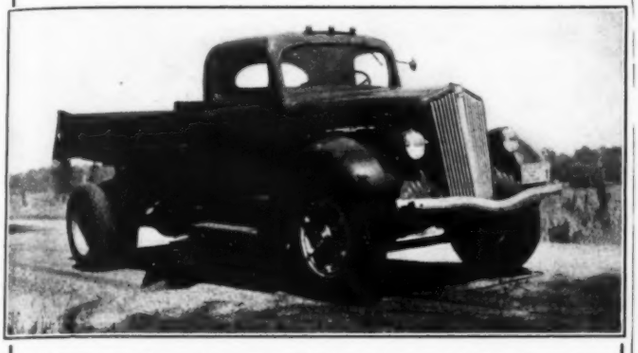
▼

Link-Belt Elects Directors

At the annual meeting of stockholders of Link-Belt Company, held at the Stevens Hotel, Chicago, March 23, four directors were elected to serve until 1941. The newly elected directors, Bernard E. Sunny, Chicago, and James S. Watson, Indianapolis, succeed Arthur L. Livermore, deceased, and Austin L. Adams, resigned. The re-elected directors are Staunton B. Peck, Chestnut Hill, Pa., and Harris Whittemore, Jr., Naugatuck, Conn. Mr. Sunny is a director of a great many companies, among which are the General Electric Co., Illinois Bell Telephone Co., Public Service Co. of Northern Illinois, Wilson & Com-

(*Continued on page* 114)

Gravel and Earth Road Maintenance



Now is the time to whip these highways in shape quickly while conditions are right. ROOT SPEED MOTOR TRUCK MAINTENANCE EQUIPMENT will do it *quicker—better—cheaper.*

Ask us what we guarantee you may expect from this type of equipment. Do not fail to mention name and model of your trucks.

Root Spring Scraper Company
Kalamazoo, Michigan

Any Width to 14 Ft.--
Laid Smooth as Velvet--
Faster than Your Plant Can Mix

With its 18 ft. straight-edge runners to equalize the surface, its semi-crawler traction all on hard subgrade, its pug-mill spreader, its ability to blend smooth joints and adjustability up to 14 ft. widths--the Jaeger Paver lays precision smooth pavements, faster and at lowest known cost. Send for Catalog and Prices.

THE JAEGER MACHINE CO. 223 Dublin Avenue Columbus, Ohio
World's Largest Builder of Spreading and Finishing Machines

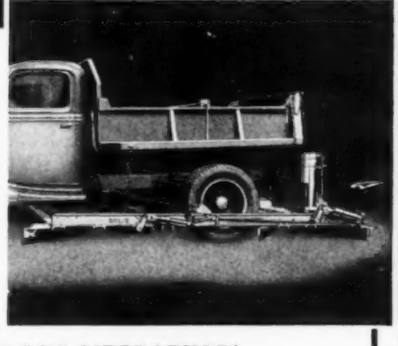
JAEGER *Bituminous* PAVER

BUY BURCH for BETTER ROADS

BURCH CHIP SPREADER

Smooth, straight line coverage, any depth and any material including one inch stone. Width and pounds per square yard controlled by independent motor. Use for Seal-Coating — Re-surfacing — Sanding Icy Roads and Streets.

BURCH ROAD MAINTAINER



Back truck on—hook up in three minutes. Raise or lower and control weight on blades hydraulically. Total length of blades three times that of single blade scrapers.

WRITE FOR LITERATURE!

THE BURCH CORPORATION
CRESTLINE, OHIO

THE RIGHT SIDE IS THE SAFE SIDE. LIFE LINE TRAFFIC MARKERS MAKE THIS PLAIN.

Life Line Traffic Markers are on the Job 24 Hours per day. They are highly visible in daylight and at night. Their visibility increases. They are unaffected by dust, rain, sleet or fog and command attention in any weather.

The Life Line System fills the need for an Efficient Day and Night Road Marker at a Very Low Cost.

National Traffic Appliance Co.

3088 West 106th St., Cleveland, Ohio

pany, Chicago Surface Lines, and the 1st National Bank, Chicago. Mr. Watson is vice president in charge of Indianapolis plant operations of Link-Belt Company, having served the company continuously for 44 years.

▼

Ver Bryck Appointed Manager Welded Wire Products Division of Wheeling Corrugating Co.

L. A. Van Bryck has been made manager of the Welded Wire Products Division of the Wheeling Corrugating Co. and will have his headquarters at Wheeling, W. Va., where the general offices and factories are located. The Welded Wire Products Division is responsible for sales of building fabric, pipe fabric and also paving fabric and accessories. Mr. Van Bryck was for a number of years associated with the Pittsburgh Steel Co.

▼

Lincoln Appoints Two Men to New York Office

Two appointments to the sales staff of its New York office, 330 West 42nd St., are announced by The Lincoln Electric Co., Cleveland, O. The men appointed are W. H. Borst, graduate in mechanical engineering from the University of Illinois, and E. A. Webber, formerly with the company's Chicago office. The new men will assist G. N. Bull, manager, and F. H. Andrews, S. G. Morris and J. B. Chamberlain, members of the New York office staff in providing welding consultation service on all phases of welding in addition to prompt service on customers' needs for welding machines, electrodes and supplies. Facilities are available for demonstrating the new "Shield-Arc SAE" welder which features "Dual Continuous Control."

▼

A. P. Armington, President Euclid Road Machinery Co., Dies

A. P. Armington, president of The Euclid Road Machinery Co., Cleveland, O., died suddenly March 18th, aboard the steamship President Adams while crossing the Pacific Ocean on a world cruise.

Mr. Armington had been suffering from heart trouble for some time and was making a trip around the world with Mrs. Armington in the hope of recovering his heatlh. He had been forced to give up the greater part of his business activities, in connection with the Euclid Company during the past year and a half because of ill health.

Mr. Armington was widely known and highly regarded among associated manufacturers and operators in the road machinery and contractors equipment trade.

▼

Nordloh Now Advertising Manager Cleveland Tractor Co.

William Abildgaard, general sales manager of the Cleveland Tractor Company, announces the appointment of Paul C. Nordloh as advertising manager. Mr. Nordloh comes to the Cletrac organization with a wide experience in the tractor and industrial field. For the past three years he was with Deere & Co., Moline, Ill., where he was responsible for a large part of the advertising and sales promotional material used on John Deere Tractors. Previously he was for nine years with the Procter & Collier advertising agency, Cincinnati, as copy and idea man.

▼

Kentucky Natural Asphalt Sales Co. to Handle Output of Diamond Rock Asphalt Corp.

Kentucky Natural Asphalt Sales Co., 155 N. Clark St., Chicago, an Illinois corporation, has made exclusive arrangements to handle the output of the Diamond Rock Asphalt Corp. of Bowling Green, Ky., producers of the famous Diamond Kentucky natural Pottsville silica sand rock asphalt from Edmonson county, Kentucky. The plant has production capacity of 1,000 tons per day and the material will meet all standard government, state and county highway specifications where rock asphalt is required. K. G. Rennie is president and W. W. Richardson vice president of the sales organization, which operates in twenty states.

▼

Jahn Trailers Now Manufactured in Chicago

The C. R. Jahn Co. announces that their trailers are now being manufactured in Chicago and no longer at La Crosse, Wis. The central location of Chicago makes possible much lower freight rates and prompter delivery. New plant facilities assure better workmanship and make available advantages for design and construction that will result in a superior product. The new location of the C. R. Jahn Co. is Builders Building, Chicago.

▼

NEW LITERATURE

Fluted Steel Pile Shells—A new 16-page illustrated catalog on fluted steel pile shells for cast-in-place concrete piles has been issued by the Union Metal Manufacturing Co., Canton, O. Description of product and method of installation, specifications for various length pile shells and many interesting job photographs are contained in this catalog. Engineers and contractors may obtain copies by writing to the above company.

Soil Testing Instruments and Apparatus—The American Instrument Co., Inc., of Silver Springs, Md., has issued a new publication, "Soil Testing Instruments and Apparatus," which is available without charge to those who make application and state their company or professional affiliations. Data concerning the mechanical analysis of soils, with accompanying flow sheet and a profuse illustration and description of the instruments and apparatus required for making soil tests, feature this new publication.

Pump Standards—The seventh edition of its standards for the pump industry has just been published by Hydraulic Institute. The enlarged publication has been completely rewritten and rearranged and much new material has been added, such as a new pump test code, charts for figuring friction of petroleum products in pipe lines, specific pump speed curves, pressure-temperature curves for pumping hot water, and chart showing resistance of valves and fittings to flow of fluids. Recommendations of materials to be used in pumps handling various liquids, instructions for installing and operating different types of pumps, and much other material has been revised and brought up to date. Price of the book is $1 and copies may be had by addressing the secretary, C. H. Rohrbach, 90 West St., New York.

Bulldozers and Gradebuilders—A 32-page bulletin describing its bulldozers and gradebuilders for use with Allis-Chalmers tractors has been issued by the Baker Manufacturing Co., Springfield, Ill. The various machines are illustrated and described and specifications are given. Numerous job pictures are included. Write for Bulletin No. 587.

Concrete Tables—Concrete tables, based on the most recent developments in concrete work and containing much information not heretofore published, are contained in an 8-page booklet printed on celluloid issued by the Pennsylvania-Dixie Cement Corp., 60 East 42nd St., New York. The booklet contains several useful tables for the efficient planning and carrying out of concrete work.

Asphalt—"Trinidasco" is the title of the latest publication of the Barber Co., 1800 Arch St., Philadelphia, Pa. The booklet describes the Trinidasco process by which asphalt pavements can be laid cold. It tells how the mixtures are prepared, outlines its use, and recites its advantages. Numerous illustrations of Trinidasco sheet asphalt pavements are included.

Crushing and Screening Equipment—A new catalog of the Pioneer Gravel Equipment Co., 1515 Central Ave. N.E., Minneapolis, Minn., describes the major plants and units of the company and gives the correct application or use of each of these items. Specifications, illustrations and descriptions of the various units are given.

Duplex Pumps—In a new bulletin, No. 6165, Fairbanks, Morse & Co., 900 South Wabash Ave., Chicago, Ill., describes its duplex, self-oiling pumps for handling mud and slush, clear water, petroleum products and other liquids. These pumps are offered as basic units, for belt drive, and with top-moupted or tandem-mounted motors. They are available with capacities from 23 to 94 gal. per minute and with pressures up to 475 lb. per square inch.

Lubricants—Because of frequent requests for non-technical information in regard to the manufacture and applicants, the Shell Petroleum Corp., Shell Bldg., St. Louis, Mo., is issuing a series of booklets entitled "Panorama of Lubrication." The first three numbers of the series have been issued and copies are available for distribution. Number 1 deals with the fundamentals of lubrication, Number 2 with lubricating friction type bearings, and Number 3 with Golden Shell the modern motor oil. The 28-page booklets are profusely illustrated and contain much useful and interesting information.

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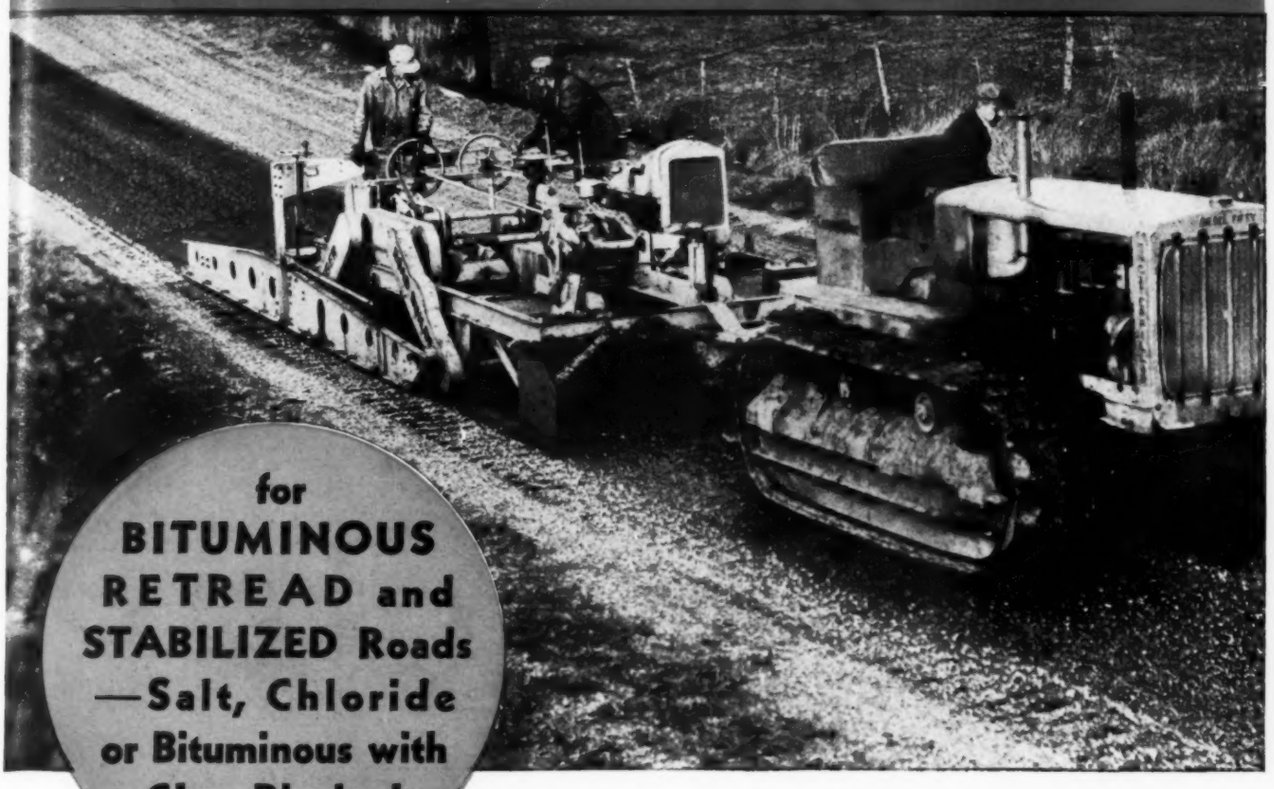

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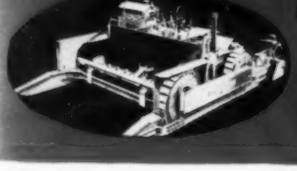

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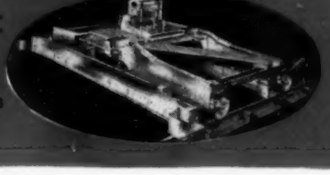

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